L. E. Orth
8-20-47

McKIERNAN-TERRY
PILE DRIVING
EQUIPMENT

INTERNATIONAL

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McKiernan-Terry

PILE HAMMERS
PILE EXTRACTORS
COMPLETE PILE DRIVING RIGS

CATALOG 60

McKIERNAN-TERRY CORPORATION
Manufacturing Engineers
15 PARK ROW, NEW YORK 7, N. Y.

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TO THE CONSTRUCTION INDUSTRY

This catalog is compiled to provide you with up-to-date information on pile driving equipment. It will show you many photographs of pile hammers in action, typifying the outstanding performance of McKiernan-Terry Hammers on important operations. This performance is the culmination of the years of experience behind these hammers and the result of their high quality.

McKiernan-Terry Pile Hammers have been and are being used on a wider variety of pile hammer operations than any other make. They are preferred by engineers and contractors all over the world for their uniform effectiveness and dependability.

The McKiernan-Terry Corporation is fundamentally an engineering organization with the most modern, well-equipped shops to produce its quality products. Large and important engineering works are designed and manufactured, involving equipment that requires sound design, quality and performance.

The same high quality and worth inherent in McKiernan-Terry Pile Hammers characterize also the other important products of our extensive manufacturing facilities and our experienced engineering organization—products that, too, have enviable records.

Large traveling bridges for the handling of coal, ore and other bulk materials; equipment for the loading and unloading of these materials from ships; machinery, mechanical and hydraulic, for the operation of dam gates and similar equipment, are continually passing through our plants. Marine equipment of our design and manufacture, to steer and anchor our Merchant and Naval ships, has an enviable reputation. We have supplied to our Navy some of the largest hydraulic equipment ever manufactured.

Typical machinery of our manufacture includes, besides pile driving equipment:

Bridge Operating Mechanisms	Gantry Cranes	Coal Unloaders
Cableways	Level Luffing Cranes	Man Trolleys and Grab Buckets
Drag Scraper Hoists	Lighterage Hoists	Whirlers
Dredge Hoists	Ore Bridges	Power Blacksmith Hammers

Steering Gears, Capstans, Windlasses, Winches
also Special Machinery Completely Designed, Engineered and Manufactured
and Special Machinery Manufactured from your Design

IMPORTANT PILE HAMMER INFORMATION

In addition to the many illustrations of McKiernan-Terry Pile Hammers in action, you will find in this volume descriptions of each of the different types of hammers we make, with complete technical data and specifications. This information should be of help to engineers and contractors in determining the most practical, speedy and economical methods of applying pile hammers to their requirements, and in selecting the hammer best suited for a given job. The many ingenious hammer applications shown are results of the originality and skill on the part of contractors, working in cooperation with McKiernan-Terry engineers.

We have always endeavored to keep in close touch with the users of our pile hammers. We desire to help make our hammers most profitable to their owners, as well as to help develop new methods to pass on to other users of McKiernan-Terry Pile Hammers all over the world. Because of this close cooperation and friendly relationship, we are kept informed on new and important projects and methods of handling them by many users of McKiernan-Terry Pile Driving Equipment.

Ludlow Ferry, Md. Bridge across the Potomac, 10,050 feet long, on U. S. Route 1 By-pass. Two McKiernan-Terry No. S-14 Single-Acting Pile Hammers drove 194-foot spliced steel H-beam piles 20 to 86 feet under water for construction of the bridge's 20 supporting piers. Two McKiernan-Terry No. S-8 Single-Acting Hammers were also used on this job. See also pages 84, 85, 105, 106, 107. Contractors, Merritt-Chapman & Scott Corp.

The Complete, Modern Line of
PILE DRIVING EQUIPMENT

McKiernan-Terry Corporation has been building pile hammers for more than fifty years. Throughout this time the Company has consistently pioneered in originating improvements in pile hammer design, and in extending the principles and applications of power-actuated rams to every kind of pile and to every class of work.

DOUBLE-ACTING PILE HAMMERS

Over fifty years ago, McKiernan-Terry first introduced the double-acting principle—a most important development in pile-driving practice. Many successive improvements in the design of these units have culminated in the present standardized McKiernan-Terry line of double-acting pile hammers described on pages 6 to 26 of this book.

HEAVY-DUTY PILE HAMMERS

As foundation projects became more extensive, involving use of larger, longer and heavier piles, McKiernan-Terry again led in developing heavy-duty double-acting pile hammers for this type of work. These McKiernan-Terry Hammers — the Type B — have relatively heavy-mass rams and low striking velocities—but maintain high frequency of blows.

UNDERWATER PILE HAMMERS

Another forward step in pile hammer design—of outstanding importance to the engineer and contractor —was the development of the underwater driving feature of McKiernan-Terry Hammers, originated by McKiernan-Terry engineers. Examples of this work are illustrated and described on pages 68 to 75.

DOUBLE-ACTING PILE EXTRACTORS

Another McKiernan-Terry development was the "double-duty" feature of certain McKiernan-Terry Double-Acting Pile Hammers. This permitted both *driving,* and — by inverting the hammer — *pulling,* with the same hammer. Then followed the development of the present-day McKiernan-Terry Double-Acting Pile Extractors, described on pages 77 to 82.

USES OTHER THAN PILE DRIVING

McKiernan-Terry Double-Acting Pile Hammers, in addition to standard pile-driving operations, have also been put to a wide variety of other uses with great success. To mention a few—

- Demolition work on brick, stone and concrete structures and pavements,
- Knocking "skulls" and "lip skulls" out of ladles in blast furnaces,
- Knocking ingots out of molds in steel mills,
- Tapping and opening cast holes in blast furnaces,
- Driving keys on sow and die blocks in large forging hammers,
- Driving metal culverts horizontally through embankments,
- Driving long tie rods horizontally for retaining walls,
- "Cleaning" huge locomotive tender frame castings by impact-produced vibration.

SINGLE-ACTING PILE HAMMERS

During the Company's over-half-a-century experience in the manufacture of pile hammers, McKiernan-Terry always recognized the value of heavy-mass rams at minimum velocity of blow—in feet per second at instant of impact—for driving heavy-mass piles in dense materials, where the higher frequency blows of double-acting hammers are of no particular advantage. Following a consistent policy of thorough preparatory work before introducing new developments, the Company devoted many years of study and research to the principles and design of single-acting pile hammers before commencing in 1933 to build this type of hammer.

For twelve years, McKiernan-Terry built and sold a number of single-acting hammers, each one an improvement on its predecessors, until, in 1945, the Company was ready to present to the construction industry a modern, perfected, standard line of single-acting hammers in five sizes. These hammers, described on pages 83 to 95, embody the first real improvement in design of single-acting pile hammers in sixty years, permitting the handling of large, special pile-driving operations for which other types of single-acting hammers prove obsolete and inadequate.

PILE-DRIVING RIGS

In the course of its development work on hammer design and applications, McKiernan-Terry has also developed various types of pile-driving rigs to meet pile driving operations of all known types. These rigs are furnished complete with leads, engines, boilers, etc., as described on pages 109 to 119.

SIX HAMMERS DRIVING AT ONE TIME

Kentucky. McKiernan-Terry Double-Acting Hammers driving the first stage of the cellular cofferdam for T.V.A.'s big Kentucky dam. Two 4-hammer rigs, 2 gantries and 2 crawler cranes were used. Photo shows 6 McKiernan-Terry Pile Hammers in simultaneous operation.

McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS

Pages 8 to 76 describe McKiernan-Terry Double-Acting Pile Hammers and illustrate many types of jobs on which they have been used. In these hammers, the motive power — steam or compressed air — not only lifts the ram, but also drives it down, thereby accelerating the speed of the down stroke. This results in a much heavier foot-pound blow than fall of the ram by gravity alone could produce.

When piling is to be used in unstable soils, such as sand, silt, loam, mud, etc., it is driven faster, further and with less damage to the pile with a double-acting hammer than with any other type. This is because of the high-frequency, powerful blows that keep the pile in constant motion, thereby keeping the adjacent soil in agitation, which in turn reduces inertia, skin friction and point resistance.

McKiernan-Terry Double-Acting Pile Hammers may be operated with either steam or compressed air. Change from one power to the other can be made without need of any kind of adjustments, except change of lubricators and oils, as explained on pages 13 to 15.

Simplicity, compactness, durability and fewer moving parts than any other pile hammer are characteristic of McKiernan-Terry construction. All moving parts are entirely enclosed, hence—

1 — They cannot injure the operator in charge,

2 — They are protected from accidental exterior damage or disarrangement,

3 — They are safe from grit and dirt—ever present on pile-driving jobs—which, by abrasive action, would cause rapid wear of working parts.

SELECTING THE PROPER SIZE HAMMER

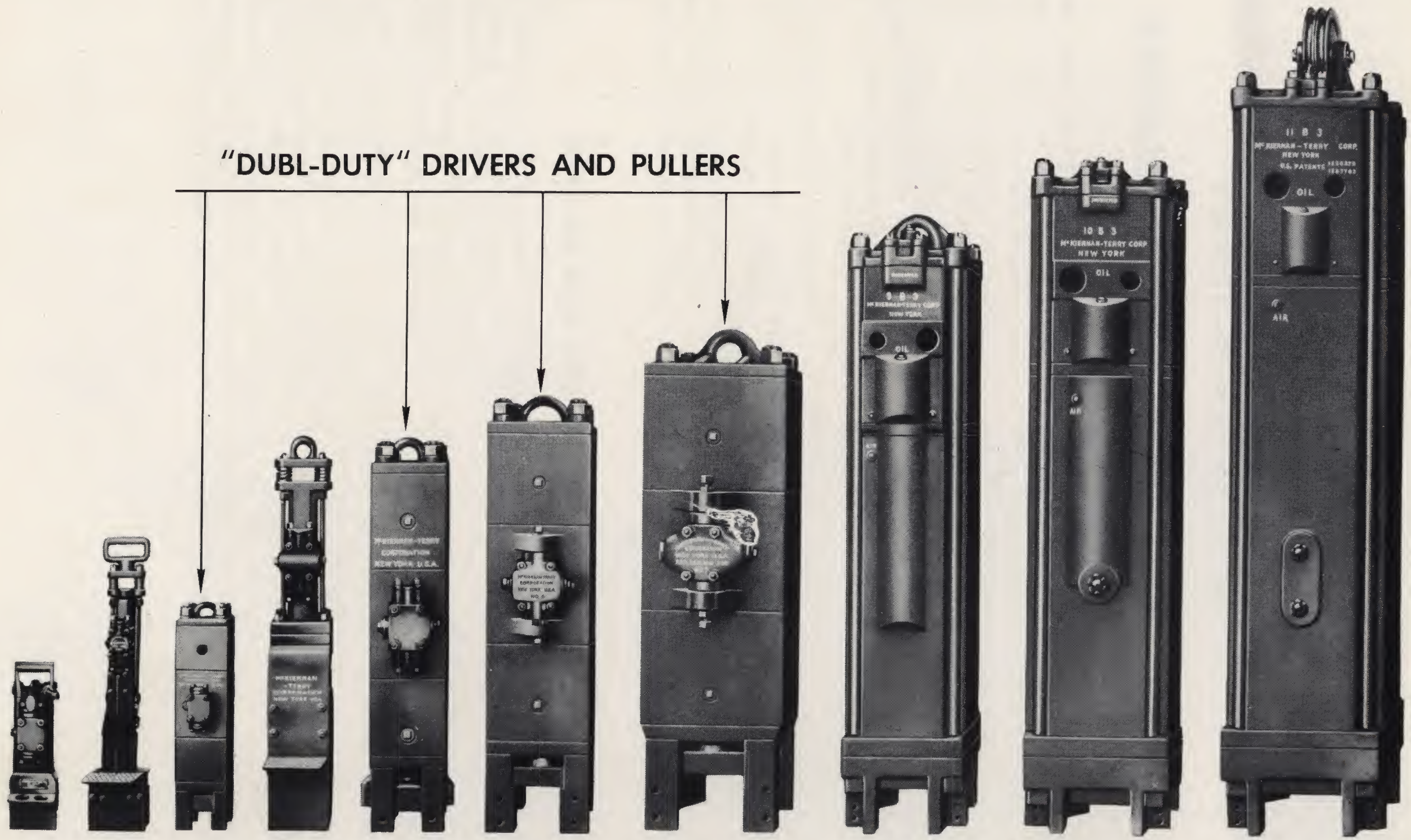
Buyers sometimes make the error of selecting a pile hammer that is too light for the work to be done. When extra weight is not actually a disadvantage, it is always recommended that the hammer be selected large enough to drive the piling into material harder than is anticipated. The weight of the hammer should be determined not only on the basis of soil resistance, but also on the weight of the individual piles to be driven.

The pile itself will absorb a part of the energy of the blow. Therefore, the hammer should have enough weight to insure sufficient surplus force to keep the pile in motion. It is not possible in this book to give close estimates of the driving capacities of the pile hammers, because of the wide diversity of materials that may have to be penetrated. However, the information on this subject given in the specification table on page 9 is the result of actual experience and can be of assistance in selecting the proper size hammer.

When ordering hammers with attached angle-iron guides for operation in pile-driver leads, be sure to specify measurements A and B as indicated on the diagram on page 10. No charge is made for attaching angle-iron guides for standard leads. If holes are to be drilled for angle irons or any other attachment, they should not be located less than 2½ inches from edge of hammer, nor drilled deeper than 1½ inches.

McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS

"DUBL-DUTY" DRIVERS AND PULLERS



0 1 2 3 5 6 7 9-B-3 10-B-3 11-B-3

SPECIFICATIONS OF McKIERNAN-TERRY DOUBLE-ACTING HAMMERS

HAMMER SIZE — No.	0	1	2	3	5	6	7	9-B-3	10-B-3	11-B-3
Net weight with flat or bell (cup) anvil, hammer only, pounds	105	145	343	675	1500	2900	5000	7000	10,850	14,000
Shipping weight, hammer and fittings, pounds	135	185	380	735	1560	2970	5075	7100	11,000	14,200
Cubic measurements, inches	8x12x25	9x11x47	11x10x37	14x13x62	19x14x57	24x19x63	27x21x73	98x20x24	112x24x26½	133½x26x28
Weight of ram, pounds	5	21	48	68	200	400	800	1600	3000	5000
Bore, inches	2¼	2¼	4	3¼	7	9¾	12½	8½	10	11
Stroke, inches	4½	3¾	5¼	5¾	7	8¾	9½	17	19	19
Blows per minute, normal	1000	500	500	400	300	275	225	145	105	95
Energy per blow, foot-pounds	....	....	240?	....	1000	2500	4150	8750	13,100	19,150
Equivalent free fall of ram, feet	....	....	5 ?	....	....	....	....	5.46	4.36	3.82
Size boiler required (boiler h.p. at 12 sq. ft. heating surface per boiler h.p.)	5	10	10	15	20	25	35	45	50	60
Compressed air required, actual cubic feet	60	70	70	110	250	400	450	600	750	900
Steam or air pressure required at hammer, pounds per sq. in. (See Note E)	100	100	100	100	100	100	100	100	100	100
Recommended steam pressure at boiler, or air pressure at compressor, pounds per sq. in. (See Note E)	125	125	125	125	125	125	125	125	125	125
Minimum size hose openings and connections from boiler/compressor to hammer, inches	¾	¾	¾	1	1¼	1¼	1½	2	2½	2½
Size of exhaust opening in hammer, inches	....	....	....	....	....	....	....	3½	4	4
Size wood sheeting or round timber piles, inches, approximate (See Note D)	2x10 / 3x8	2x10 / 3x10	3x8	3x12	4x12	6x12	10x14	17	20	21
Penetration in average material, feet, approximate	3–4	4–6	6–10	6–10	10–15	15–20	20–30	30–40	50–70	60–80
Size steel sheet piling, inches, approximate	9	9	9	12	12	12	Largest	Largest	Largest	Largest
Penetration in average material, feet, approximate	5–6	6–10	10–15	10–15	15–20	20–30	30–40	50–60	60–80	70–100
Code word for hammer	ORFOR	OPLAS	OPLET	OPLIX	OPLUZ	OPMAT	OPMEX	OPNOD	OPNIZ	OPNEY

NOTES: A—When ordering, be sure to specify whether hammer is to be operated with AIR or STEAM, so that lubricator of proper type may be furnished.

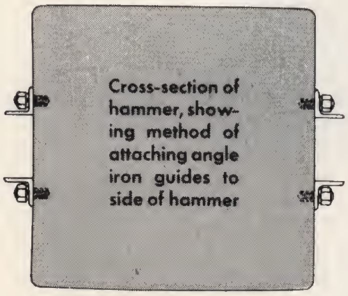
B—When ordering size 7, 9-B-3, 10-B-3 or 11-B-3 hammer, specify whether a standard flat or bell (cup) anvil is wanted. Other sizes furnished with flat anvils only. If other types of anvil or drive cap are required, they will be furnished at additional cost, after receipt of complete specifications of piling to be driven. See page 10.

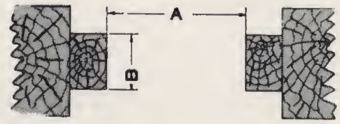
C—If angle iron guides are to be attached, give lead measurements A and B, as indicated on page 10.

D—If ordering size 0 to 1 hammer, specify size of sheeting to be driven.

E—Figures for steam pressure at hammer and at boiler are approximate, given as a guide. Actual pressures required will vary with the weather, and with the installation of the boiler, length of steam line from boiler to throttle valve, and length of hose used. The actual steam pressure and volume must be regulated by means of the throttle valve and by varying the steam pressure at the boiler so that hammer will run at speed indicated in table. Hammers must not be run faster than the rated speed.

ATTACHING ANGLE-IRON GUIDES


Cross-section of hammer, showing method of attaching angle iron guides to side of hammer



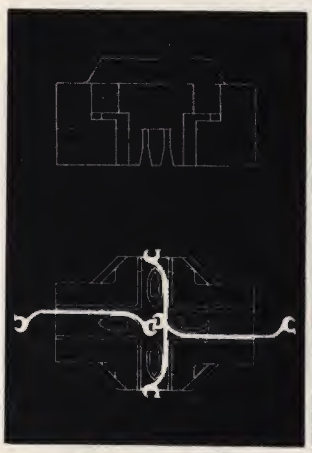
When ordering hammers with angle-iron guides attached, be sure to specify measurements A and B indicated above, adding ¾-inch to *actual* dimension A and ½-inch to *actual* dimension B.

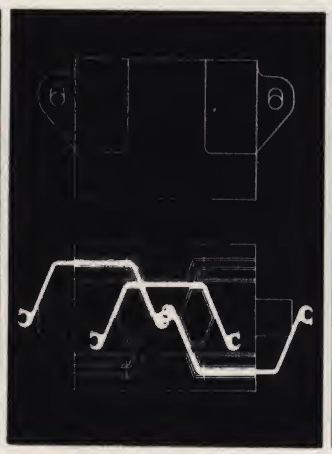
FOR DRILLING ANGLE-IRON HOLES

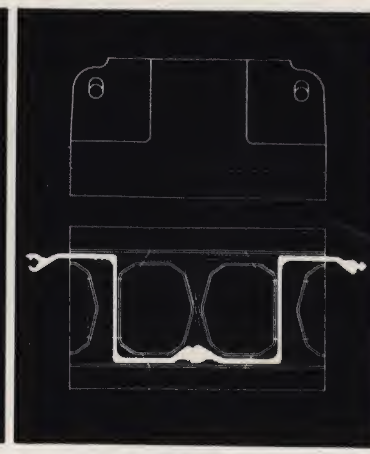
Hammer Number	Size Stud Inches	Depth Tapping Inches	Holes Required
5	¾	1	16
6	⅞	1¼	12
7	1	1¼	16
9-B-3	1	1¼	20
10-B-3	1	1¼	24
11-B-3	1	1¼	24

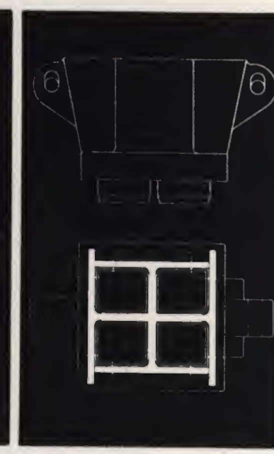
Angle-iron guides are furnished unattached, unless order specifies otherwise. They will be attached at factory without additional charge, provided dimensions A and B, shown above, are provided. If guides are not required to be attached at factory, we will provide—on application specifying hammer size—a detailed dimension print, showing exactly where and how to attach them. In drilling angle-iron holes be sure *not to drill them deeper than the dimensions shown in table above.*

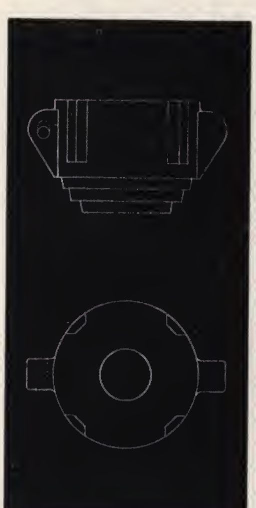
ANVILS AND BASE ATTACHMENTS

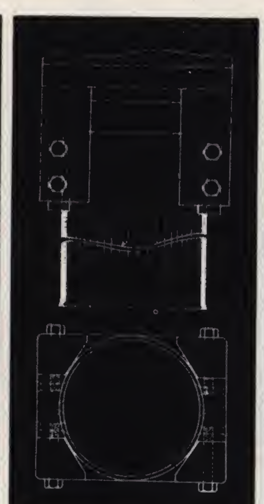

No. B-2992. For driving one and/or two pieces of straight web steel sheet piling.

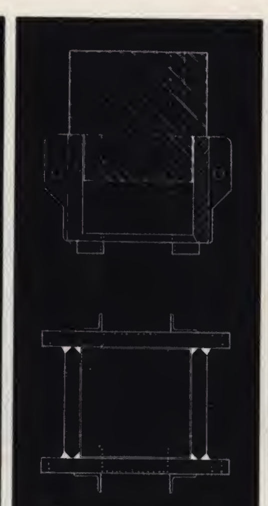

No. B-2993. For driving one and/or two pieces of deep arch steel sheet piling.

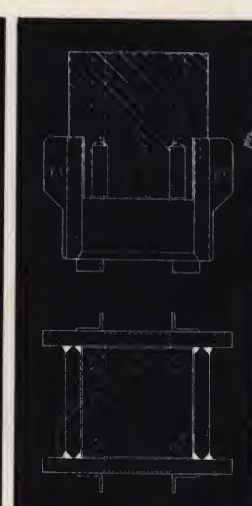

No. B-2994. For driving one and/or two pieces Z-section steel piling.


No. B-2991. For driving steel H-beam piles.

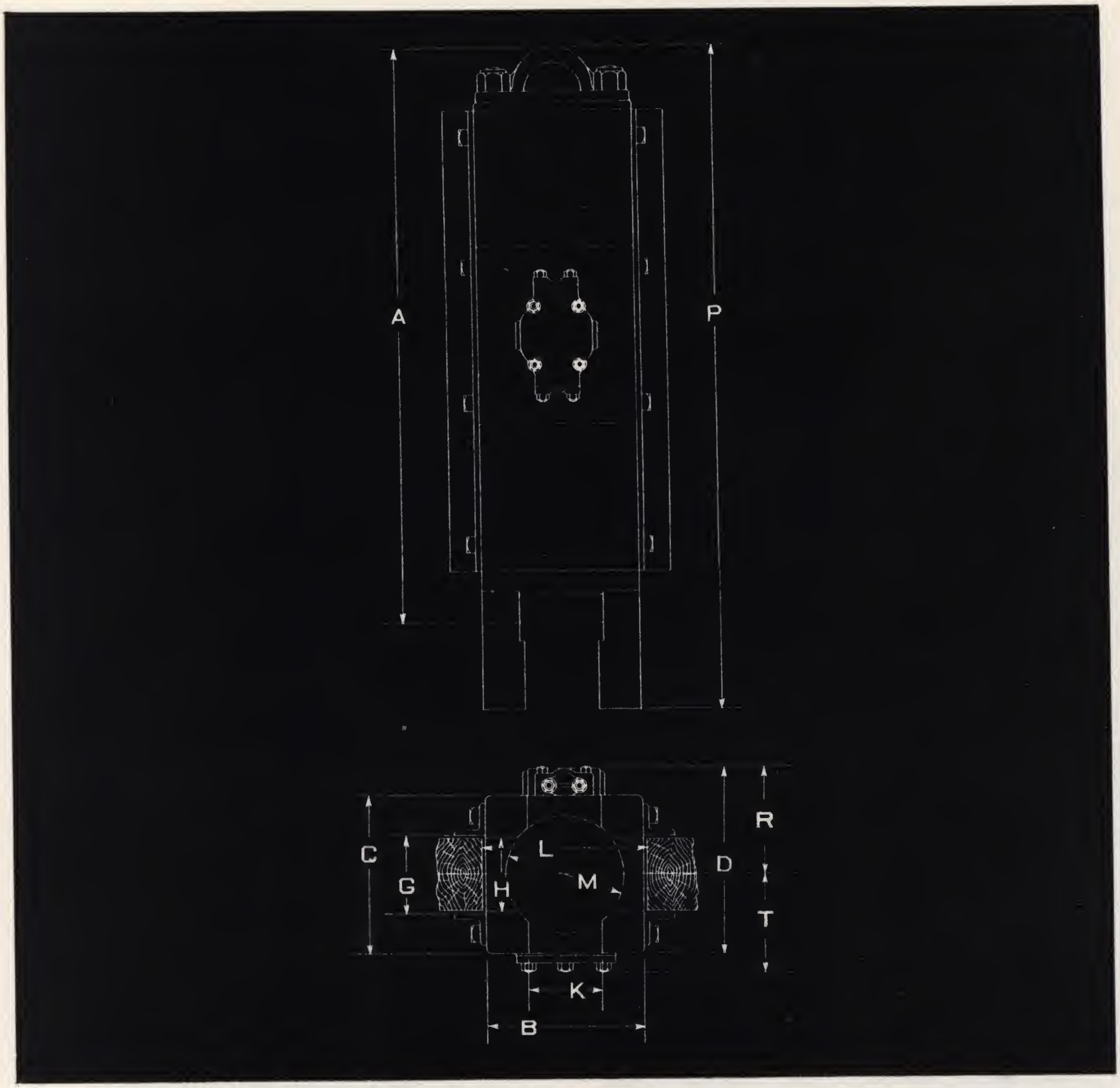

No. C-1616. For pipe piles of all sizes.


No. C-870. Pipe sleeve, diameter determined by dimension M, page 11.


No. A-1943. For smooth butt concrete piles.


No. A-1944. For concrete piles with extended reinforcing rods.


Filler pieces for steel sheet piling or Wakefield wood sheet piling.



DIMENSIONS OF McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS

Size No.	A Inches	B Inches	C Inches	D Inches	G	H Inches	K Inches	L Inches	M Inches	P Inches	R Inches	T Inches
0	20	6	4	7 3/16	....	2 1/4–3 1/4	....	....	....	25	4 3/4	3 1/4
1	39	8	6	5 7/8	....	2 1/4–3 1/4	....	....	....	43	4 1/4	1 5/8
2	29	7 1/2	6 5/8	9 1/8	....	3 1/8	3 1/8	....	4 3/8	33	5 7/8	3 1/4
3	53	9	9 1/2	8 7/8	....	3 5/8	....	....	....	58	6 1/8	2 3/4
5	51	11	11	14 7/8	....	4 1/4	4 1/4	12	6	57	9 3/8	5 1/2
6	55	15	15	19 1/8	....	7	7	16	11 1/4	63	11 5/8	7 1/2
7	63	21	16	22 7/8	As Required	7	11	22	16	73	14 7/8	8 3/4
9-B-3	89 1/4	20	20	23 3/8		9	9	21	15	98	13 3/8	11 5/8
10-B-3	102 3/4	24	24	26 3/8		11	11	25	19	112	14 3/8	12
11-B-3	124 1/2	26	26	27 5/8		13 1/2	13 1/2	27	22	133 1/2	14 5/8	13

OPERATING INSTRUCTIONS

FOR McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS

A—LEADS RECOMMENDED

The use of leads to guide the hammer in driving is recommended. Driving without leads usually results in misalignment of the hammer with the pile, causing excessive wear or breakage of the striking end of the ram and the anvil.

Angle iron guides are furnished with each hammer to guide the hammer in the leads. Guides should be spaced one-half inch wider, back to back, than the width of the faces of the leads. The guides are furnished unattached, unless dimension for spacing of guides is specified when ordering hammer.

Leads should be spaced one-half to three-quarters inch wider apart than width of hammer, so hammer will not bind in leads.

B—HOSE CONNECTIONS

The size hose specified for each hammer should always be used. Use of a smaller size than that specified may result in the hammer not running up to the rated number of blows per minute.

The hose should be connected to the steam inlet flange. Fittings, consisting of a nipple and an elbow, are furnished with each hammer. Universal joints for connecting hose to the hammer are recommended, but are not furnished as standard equipment.

Before connecting hose to steam inlet, the hose should be thoroughly blown out with steam or air.

The operation of the hammer will be improved if a drain cock or valve is installed in the steam line as near to the hammer as possible, so that condensed steam may be blown out before starting to drive each pile.

Do not use worn out hose. Pieces of rubber or lining may get blown into the hammer and clog ports or valve.

C—PRECAUTIONS AGAINST WEAR, DAMAGE AND BREAKAGE

1. Use adequate lubrication with the right kind of oil.
2. Keep hammer in line with pile.
3. Keep full weight of hammer on pile while driving.
4. Do not use excessive steam or air pressure, as it will cause hammer to over-stroke and lift off pile on up-stroke.
5. Do not continue to drive on piles at refusal. Continued driving on piles which have stopped moving will damage piles and break hammer parts.
6. Do not use full power of hammer when starting piles or during very easy driving.
7. Keep tie rod nuts tight.

D—STARTING DIRECTIONS

A cold hammer should be warmed up slowly, by cracking the throttle valve and admitting steam or air to the cylinder, so that the hammer will run slowly and the ram make short strokes. In cold weather a large amount of steam will condense in the steam line and hose and inside the hammer. This condensate or water must be worked through the hammer before running hammer at full speed.

When starting a pile and during easy driving, the hammer should be run slowly with short strokes, so that the pile will not be driven out from under the hammer causing damage to the tie rods and drive cap.

The full weight of the hammer must rest on the pile while the pile is being driven. The hoisting line must be kept slack at all times while the pile is being driven, so that the ram will not strike the retainer and damage the hammer.

Continued operation of the hammer when the full weight of hammer is not resting on the pile will cause breakage of the tie rods and separation of the piston from the ram.

E—DISASSEMBLING HAMMER

(See Pages 17 to 26 for identification of parts)

To take apart Nos. 9-B-3, 10-B-3 or 11-B-3 hammers, remove four tie rod nuts, and lift off top head and top cylinder in one piece. Remove valve from top cylinder. Lift out cam rod. Place eye-bolt in top of piston. Lift piston, ram and intermediate head out of bottom cylinder in one piece. Do not remove piston or cam throw from ram unless necessary to make repairs. Reverse above operations to reassemble hammer.

Since Nos. 0, 1 and 3 Double-Acting Hammers are of a very open frame construction, their disassembly will be obvious.

To disassemble Nos. 2, 5, 6 and 7 Hammers remove the four tie rod nuts on the top head, then lift off the top head next, then the top cylinder. Place eye bolt in

top of ram. Lift out ram. Next lift out middle cylinder. Next bottom cylinder, leaving the bottom head and anvil and four tie rods exposed. These parts can be taken apart by merely withdrawing the four tie rods.

F—PACKING PISTON

To pack the piston—square packing, Garlock #15 or #777, is recommended.

No. 0 Hammer requires no packing.

For No. 1 Hammer, use four rings of 5/16-in. square packing.

For No. 3 Hammer, use four rings of 3/8-in. square packing.

For No. 9-B-3, 10-B-3 and 11-B-3 Hammers, use four rings of 5/8-in. square packing.

Do not use more than four rings.

Nos. 2, 5, 6 and 7 Hammers require no packing.

On Nos. 1 and 3 Hammers, gland stud nuts should be made up evenly, so that gland will exert even pressure on the packing. Gland should compress packing very lightly. Packing will be kept tight by steam or air pressure. Severe compression will cause undue wear of packing and hinder free movement of the piston. Gland nuts must be made fast with wire to prevent working loose when hammer is driving.

The packing gland in the 9-B-3, 10-B-3 and 11-B-3 Hammers is of the self-aligning type and merely requires a complete assembly of the gland ring, gland spring holder pins, gland springs, gland spring holder and the packing, so that, when assembling the hammer, the packing will be properly aligned. There are no stud or gland nuts to be adjusted.

G—CARE OF HAMMER IN TRANSIT AND WHEN NOT IN SERVICE

Plug inlet and exhaust to keep dirt out of hammer.

If hammer is to be out of service for a period under three months detach hose and pour one quart of oil down hose. Reattach hose and run hammer for several strokes to flush oil through hammer. Drain water which may have condensed in cylinder by removing drain plugs. Replace plugs to prevent entry of dirt.

If hammer is to be out of service for a period over three months take hammer apart, dry all parts, thoroughly coat them with oil and reassemble.

H—COLD WEATHER PRECAUTIONS

When hammer is not being used during cold weather, all water should be drained out of the top cylinder by removing drain plugs. Failure to drain cylinder may result in cracking of the cylinder due to freezing.

I—INSTRUCTIONS FOR UNDERWATER DRIVING

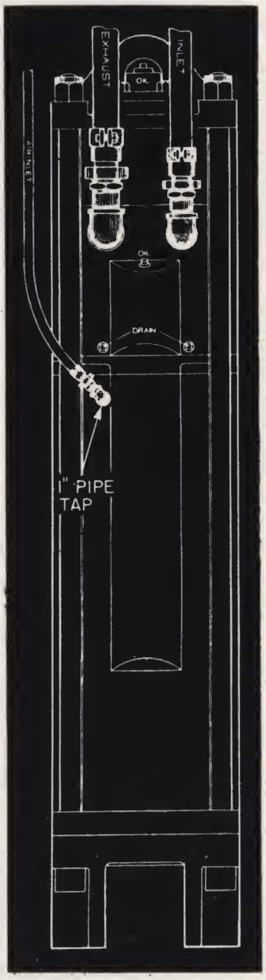
Cut at right shows how to attach the air inlet hose to bottom cylinder which is necessary for underwater driving with McKiernan-Terry Double-Acting Pile Hammers.

It is highly recommended that a lubricator be placed on the air line connected to the bottom cylinder and the same oil used as suggested for the steam line. (See section M.)

The exhaust line must be carried to the surface of the water. Use exhaust hose of at least the size recommended in specification table page 9; but for submergence greater than approximately 15 feet use even larger hose — as large as possible.

About 60 cubic feet of compressed air per minute is sufficient volume for any size hammer, and about 1/2-lb. pressure for every foot of submergence is required.

All hose should be kept out of water as much as possible, and free of kinks or bends.



Hose attached for underwater driving

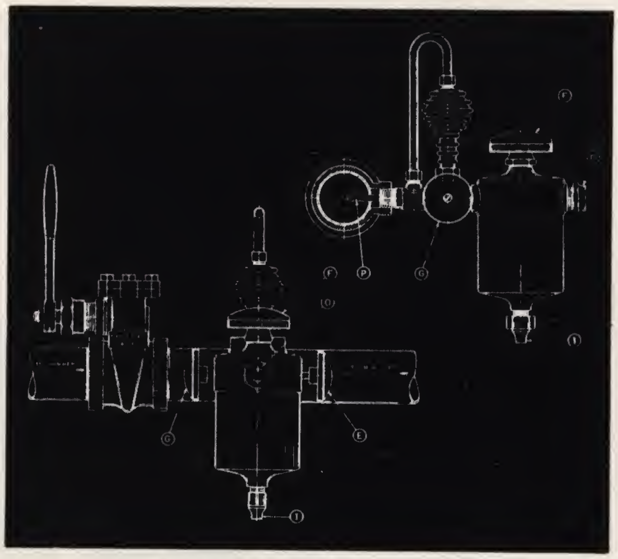
LUBRICATION—PLEASE READ AND FOLLOW CAREFULLY

Adequate lubrication is absolutely necessary for satisfactory pile hammer operation. Insufficient oil or use of the wrong kind of oil causes shut-down, excessive wear and costly repairs.

All McKiernan-Terry Pile Hammers will operate on either steam or compressed air. No changes, except in lubrication, are necessary in changing from steam operation to air operation.

J—TO LUBRICATE FOR *STEAM OPERATION*

A Swift Sight-Feed Lubricator for steam operation —see picture—is furnished with each No. 5 or larger McKiernan-Terry Double-Acting Pile Hammer, but any standard sight-feed lubricator, if properly installed and operated, will do.



Sight-feed lubricator for steam operation

The purpose of the lubricator is to supply oil to the steam so that it is carried inside the hammer to lubricate piston and steam cylinder. The lubricator should be carefully installed as per directions, and must be kept filled and in operation while the hammer is running.

K—HOW TO INSTALL STEAM LUBRICATOR

The lubricator should be placed on the steam line back of the throttle valve; that is, between throttle valve and boiler. The connection from lubricator to steam line should be made through a tee, with the oil outlet pipe P extending into the center of the steam line.

Be sure that the oil outlet pipe P extends all the way into the flow of steam and is at right angles to the flow.

This is necessary so that steam passing through the line will carry oil in the *center* of the hose and not along the sides.

Never mount lubricator at a bend in the steam line where the flow of steam will strike the oil outlet pipe P head-on, as this will cause lubricator to work intermittently.

L—HOW TO OPERATE STEAM LUBRICATOR

Close valves E and G. Remove filler plug F and fill oil reservoir full to very top, and replace F. The bright nickel-silver plate showing the sight feed O will now be completely covered with oil.

Open valve E about one-half turn, then allow five or ten minutes, on a new installation, for steam to condense and form the water column. Then open valve G very carefully. Drops of water will commence to roll down over the bright plate. Each drop will cause a drop of oil to be forced into the steam line.

Valve G should be regulated to give at least one drop of oil to every ten blows of the hammer. Avoid opening valve G too wide. If water runs in a stream, instead of in drops, oil will be wasted.

When the oil in the reservoir is nearly exhausted water will commence to show at the bottom of sight-feed O, gradually rising and showing on the sight-feed plate. Although there will be still enough oil to run for some time, it is best to refill when the water shows.

To refill reservoir, close valves E and G to shut off lubricator from steam line, open I and remove plug F to drain off water. Then proceed to refill as above. When hammer is not operating, valve G should always be closed.

If the lubricator is connected in such a way as to cause variable pressure, better results can be obtained by closing valve E to about the same opening as valve G, making the adjustment after lubricator has commenced feeding.

M—SELECT THE RIGHT OIL FOR USE WITH STEAM

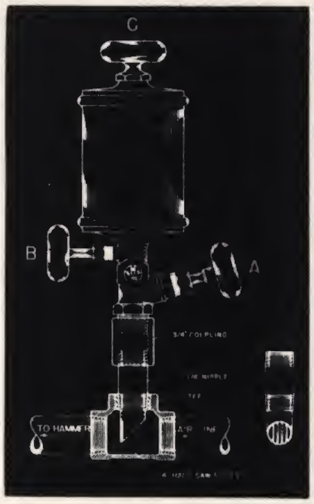
Steam hammers are often required to run on wet steam, due to unavoidable operating conditions and the length of steam line and hose between boiler and hammer. Therefore we recommend high grade compounded steam cylinder oil containing 5% to 7% animal oil.

Oil of this type produces an emulsifying effect when in contact with moisture, and the resulting lather resists the tendency of wet steam to wash oil off the internal moving surfaces of the hammer. Oil meeting the following specifications has proved successful under average conditions:

Gravity—degrees API	22-25
Pour Point—degrees Fahrenheit	10-40
Flash Point—degrees Fahrenheit	525-590
Viscosity—Saybolt seconds at 210 degrees	120-140
Percentage of compounded oil—usually acidless tallow or lard	5%-7%

Typical oils meeting these specifications include Socony-Vacuum Gargoyle Cylinder Oil 600-W Regular; Standard Oil of New Jersey Cylesso T-140; Texas Company Honor Cylinder Oil; Gulf Oil Corporation Crystal Cylinder Oil B.

N—TO LUBRICATE FOR *AIR OPERATION*



Air lubricator

A Swift Sight Feed Lubricator to be used on the air line when hammer is operated on air, is furnished with each McKiernan-Terry Double-Acting Pile Hammer for sizes No. 5 and larger. For sizes No. 3 and smaller a regular line oiler is furnished. A Sight Feed Lubricator is also used on the air line of 9-B-3, 10-B-3 and 11-B-3 Hammers, connected to bottom cylinder when hammer is operated in underwater driving. Note underwater instructions, section I.

O—HOW TO INSTALL AIR LUBRICATOR

The lubricator should be placed on the air line, back of the throttle valve; that is, between throttle valve and air receiver or compressor. The connection from lubricator to air line should be made through a tee, with the oil outlet pipe extending into the center of the air line.

Be sure that the oil outlet pipe extends all the way into the flow of air and is at right angles to the flow.

Illustration shows correct method of installing lubricator in air line so that air passing through the line will carry oil in the *CENTER* of the hole and not along the side.

Never mount lubricator at a bend in the air line where the flow of air will strike the air outlet pipe head-on, as this will cause lubricator to operate intermittently.

P—HOW TO OPERATE AIR LUBRICATOR

Close valves A and B. Remove cover C and fill oil reservoir. Replace cover C and open valve B. Then open valve A very carefully and regulate it to give at least one drop of oil to every ten blows of the hammer. When lubricator needs refilling, close valves A and B, remove cover C and repeat above operation.

It is necessary that a steady supply of oil be fed into the air line whenever hammer is in operation. Operation without oil for even a brief period may cause serious damage to the hammer.

Q—OILS FOR AIR OPERATION

The oils recommended for steam operation should not be used when the hammer is operated on air, because they are too heavy and sticky unless heated by steam. Oil of approximately the following specifications is recommended for air-driven hammers:

Gravity—degrees API	17-28
Pour Point—degrees Fahrenheit	0 to –10
Viscosity—Saybolt seconds at 210 degrees	48-60
Percentage of compounded oil	0 to 3%

The following brands of oil have been used successfully in air-driven hammers: Socony-Vacuum Gargoyle D.T.E. Heavy Medium; Gulf Oil Corporation Harmony Oil D or Seneca Oil B; Texas Company Ursa Oil C; Standard Oil of New Jersey Teresso 52.

R—OILS FOR UNDERWATER DRIVING

Hammers operate on very wet steam under water, due to the cold water in contact with the steam hose and outside surfaces of hammer. This causes steam to condense, with the result that a large amount of water is carried along with the steam.

This excess water makes it necessary to use a cylinder oil containing 10% to 12% compound animal oil, in order to insure that oil will adhere to the moving parts.

Socony-Vacuum Gargoyle P. E. Cylinder Oil Dark and similar oils containing 11% compounded lard have proved successful and are recommended for underwater use.

S—INTERNAL LUBRICATION

Oil reservoir A at top of valve and oil reservoir B in the face of the steam cylinder should be kept filled with the oil recommended above. Reservoir A oils the valve. Reservoir B oils the cam rod bearings, cam rod, and cam throw.

As the oil in these reservoirs drips out steadily, whether the hammer is in operation or not, the reservoirs should be completely filled at start of driving, and refilled at least every hour the hammer is in operation.

FORMULA FOR COMPUTING BEARING CAPACITY

OF PILES DRIVEN BY DOUBLE-ACTING PILE HAMMERS

The "Engineering News" formula which is given below is generally used by engineers to determine the bearing capacity of piles driven with McKiernan-Terry Double-Acting Pile Hammers.

$$L = \frac{2\,E}{S + .1}$$

In this formula,

L = Safe bearing capacity in pounds.
E = Energy, or foot-pounds per blow.
S = Set, or penetration, in inches per blow.
.1 = Constant.

The assumed safety factor of this formula is 6.

The following illustration of the use of this formula is based on running a 9-B-3 Hammer 145 strokes per minute, and developing an 8,750-foot-pound blow.

$$L = \frac{2 \times 8750}{S + .1}$$

Attention is called to the fact that the energies herewith published for the 9-B-3, 10-B-3 and 11-B-3 Hammers are not the usual "Rated Energies", but are the actual foot-pound blows at the various speeds listed. These data are obtained by very careful calibration of these hammers and determined by exhaustive tests, not only by indicator diagrams, but also by high speed moving picture apparatus, which actually determines the velocity of the ram at the point of impact.

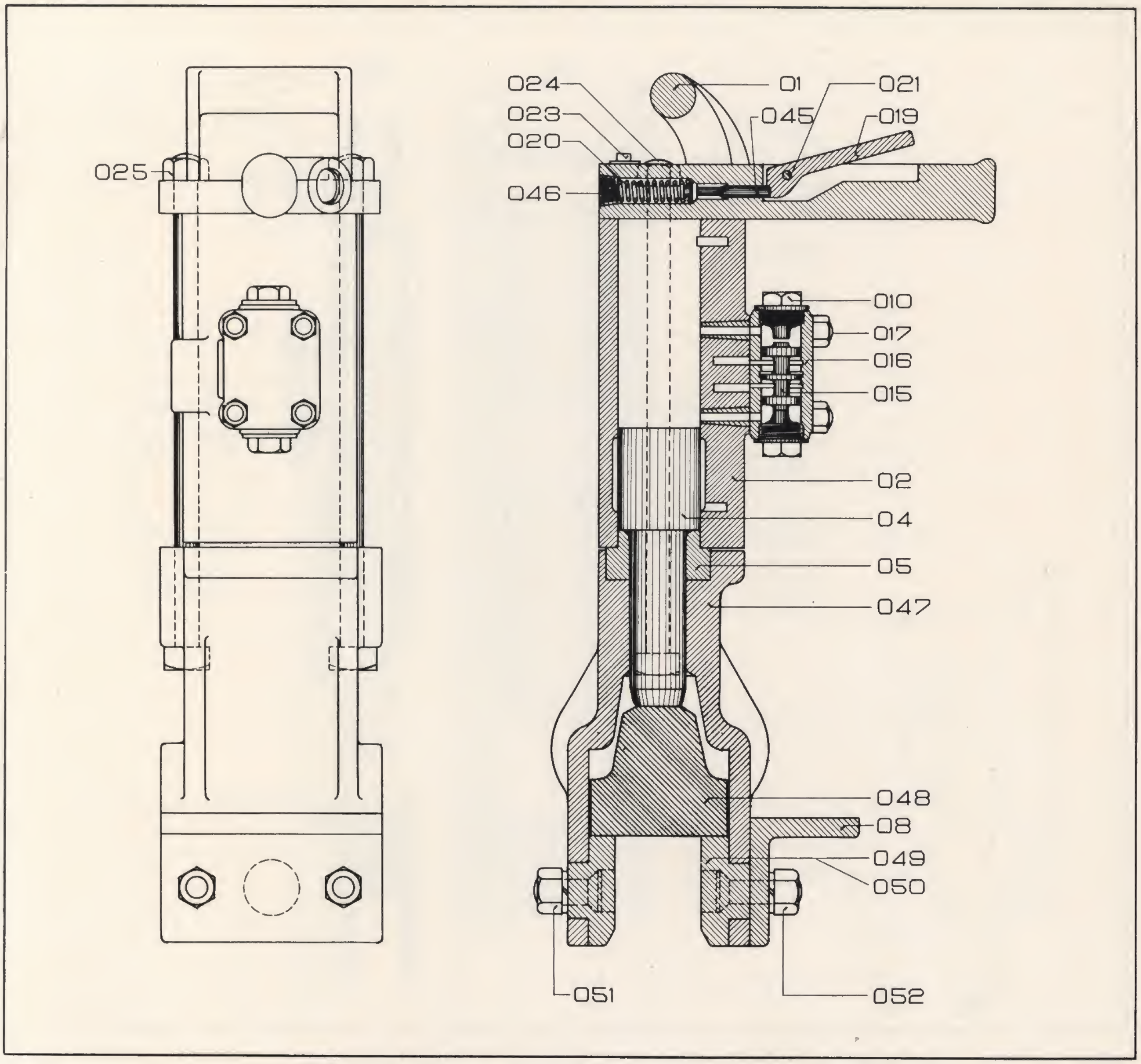
Calculations based on gauge pressures in the field are misleading, because no two "setups" are identical, and it is impossible to determine the Mean Effective Pressure in the working cylinder from the boiler pressure as shown by the gauge, but figures given in table below for sizes Nos. 6 and 7 are based on indicator card readings taken at the factory, and for sizes 9-B-3, 10-B-3 and 11-B-3, both indicator card data as well as velocities of ram at impact are used to determine their foot-pound blow at various strokes per minute.

Size of Hammer No.	Weight of Ram Pounds	Lifting Area of Piston Square Inches	Striking Area of Piston Square Inches	Length of Stroke Inches	FOOT-POUNDS BLOW AT GIVEN STROKES PER MINUTE	
					Strokes per Minute	Foot-Pounds per Blow
6	400	36.18	36.18	8¾	275	2,500
					230	2,160
					200	1,680
7	800	55.6	55.6	9½	225	4,150
					195	3,720
					170	3,280
9-B-3	1,600	40.85	56.75	17	145	8,750
					140	8,100
					135	7,500
					130	6,800
10-B-3	3,000	58.91	78.54	19	105	13,100
					100	12,000
					95	10,900
					90	9,550
11-B-3	5,000	75.40	95.03	19	95	19,150
					90	18,300
					85	17,500
					80	16,700

BEARING CAPACITY OF PILES DRIVEN BY McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS

Using "Engineering News" formula $L = \frac{2\,E}{S + .1}$ where E is foot-pounds per blow developed at normal number of strokes per minute shown in specification table on Page 9.

Penetration per blow Inches (S)	BEARING CAPACITY OF PILES IN [redacted] POUNDS			
	No. 7	No. 9-B-3	No. 10-B-3	No. 11-B-3
.1	41,500	87,500	131,000	191,500
.2	27,666	58,333	87,333	127,666
.3	20,750	43,750	65,500	95,750
.4	16,600	35,000	52,400	76,600
.5	13,833	29,166	43,666	63,833
.6	11,857	25,000	37,428	54,714
.7	10,375	21,875	32,750	47,875
.8	9,222	19,444	29,111	42,555
.9	8,300	17,500	26,200	38,300
1.	7,545	15,909	23,818	34,818

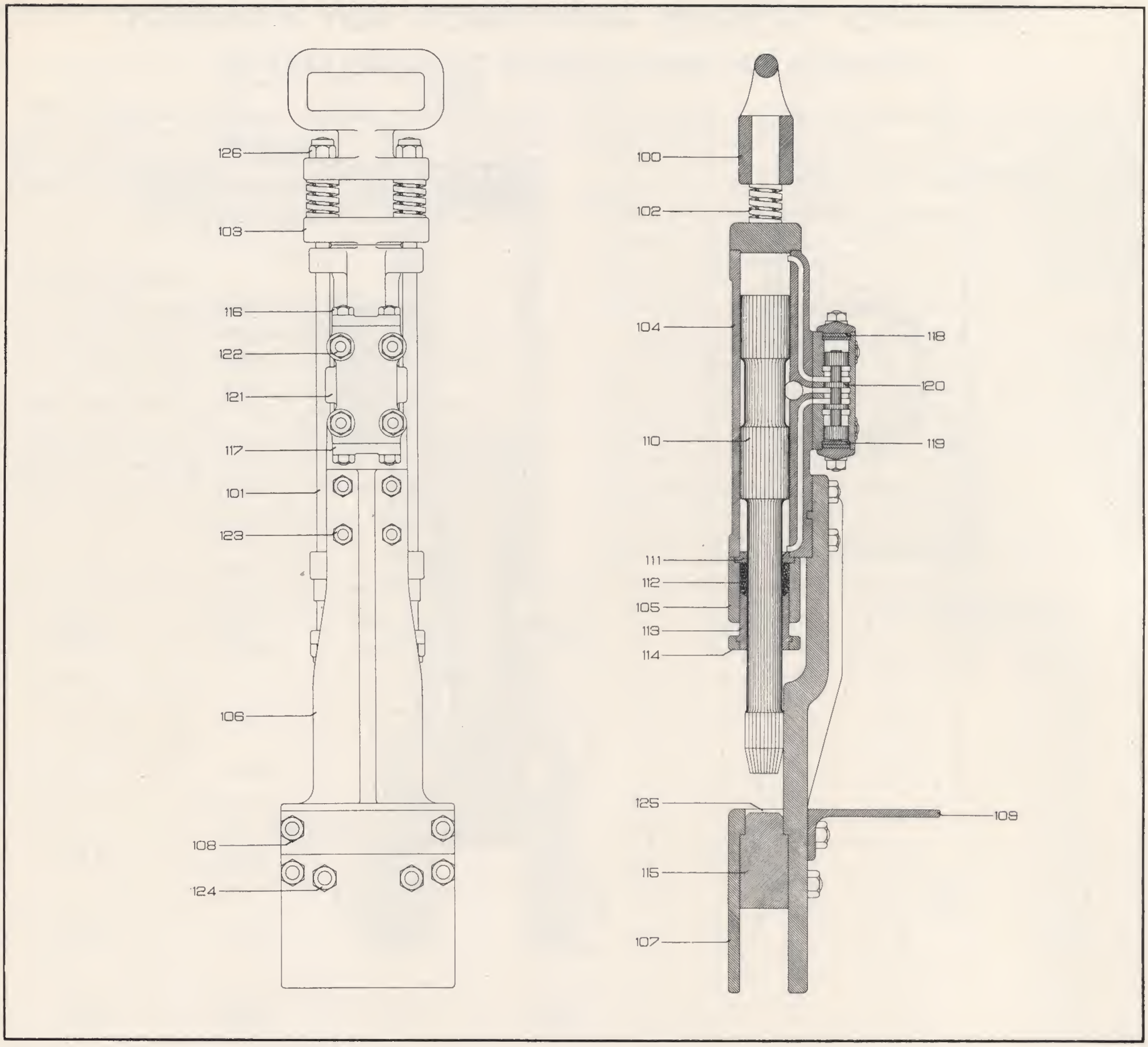


PARTS LIST FOR NO. 0 PILE HAMMER

No. 0 Pile Hammer Code Word—ORFOR

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
01	Top Head	1	AHAHT	025	Side Rod Nut	2	AHCET
02	Cylinder	1	AHALF	045	Inlet Valve	1	AHCIX
04	Piston	1	AHAMA	046	Spring Stop	1	AHCOY
05	Piston Bearing	1	AHANE	047	Front Head	1	AHCUZ
08	Step	1	AHAPI	048	Anvil	1	AHDAT
010	Chest Cover	2	AHARO	049	Front Head Cap, for 2-in. sheeting	2	AHDEX
015	Valve	1	AHASU				
016	Valve Chest	1	AHATY	050	Front Head Cap, for 3-in. sheeting	2	AHDIH
017	Chest Stud and Nut	4	AHBAR				
019	Inlet Valve Handle	1	AHBES	051	Front Head Cap Bolt	2	AHDOZ
020	Inlet Valve Spring	1	AHBIT	052	Front Head Cap and Step Bolt	2	AHDUL
021	Inlet Valve Handle Pin	1	AHBOX				
023	Oil Plug	1	AHBUY				
024	Side Rod	2	AHCAS	054	Front Head Bushing	1	AHECH

Hammer can be supplied for either 2-inch or 3-inch wood sheeting.

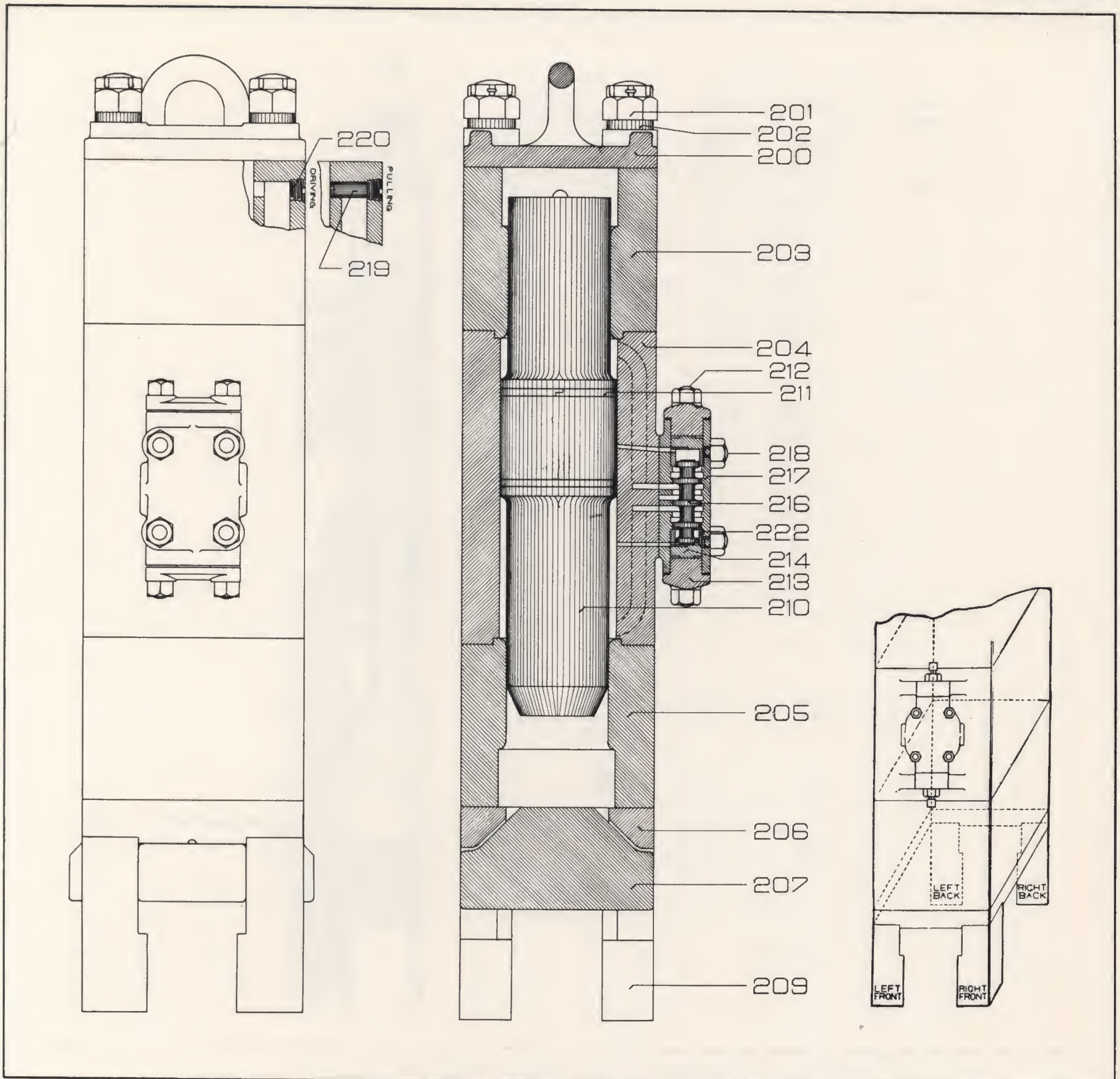


PARTS LIST FOR NO. 1 PILE HAMMER

No. 1 Pile Hammer Code Word—OPLAS

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
100	Bail	1	ABFAF	113	Packing Sleeve—2 pieces	1	ABHOX
101	Side Rod	2	ABFEP	114	Packing Sleeve Gland	1	ABHUY
102	Top Head Spring	2	ABFIR	115	Anvil	1	ABIGT
103	Top Head	1	ABFOS	116	Chest Cover Stud and Nut	4	ABIHZ
104	Cylinder	1	ABFUT	117	Chest Cover	2	ABILS
105	Bottom Head	1	ABGAP	118	Valve Buffer	2	ABINA
106	Base Block	1	ABGER	119	Valve Washer	2	ABIPE
107	Base Block Cap*	1	ABGIS	120	Valve	1	ABIRI
108	Base Block and Nut	4	ABGOT	121	Valve Chest	1	ABISO
109	Step	1	ABGUX	122	Chest Stud and Nut	4	ABITU
110	Ram	1	ABHAR	123	Cylinder Stud and Nut	4	ABIVY
111	Bottom Head Split Ring—2 pieces	1	ABHES	124	Anvil Block Guide Bolt and Nut	2	ABJAS
112	Piston Rod Packing 5/16 sq.—4 Rings	....	ABHIT	125	Base Block Distance Piece	2	ABJET
				126	Side Rod Nut	4	ABJIX

*Can be supplied for either 2-inch or 3-inch wood sheeting.

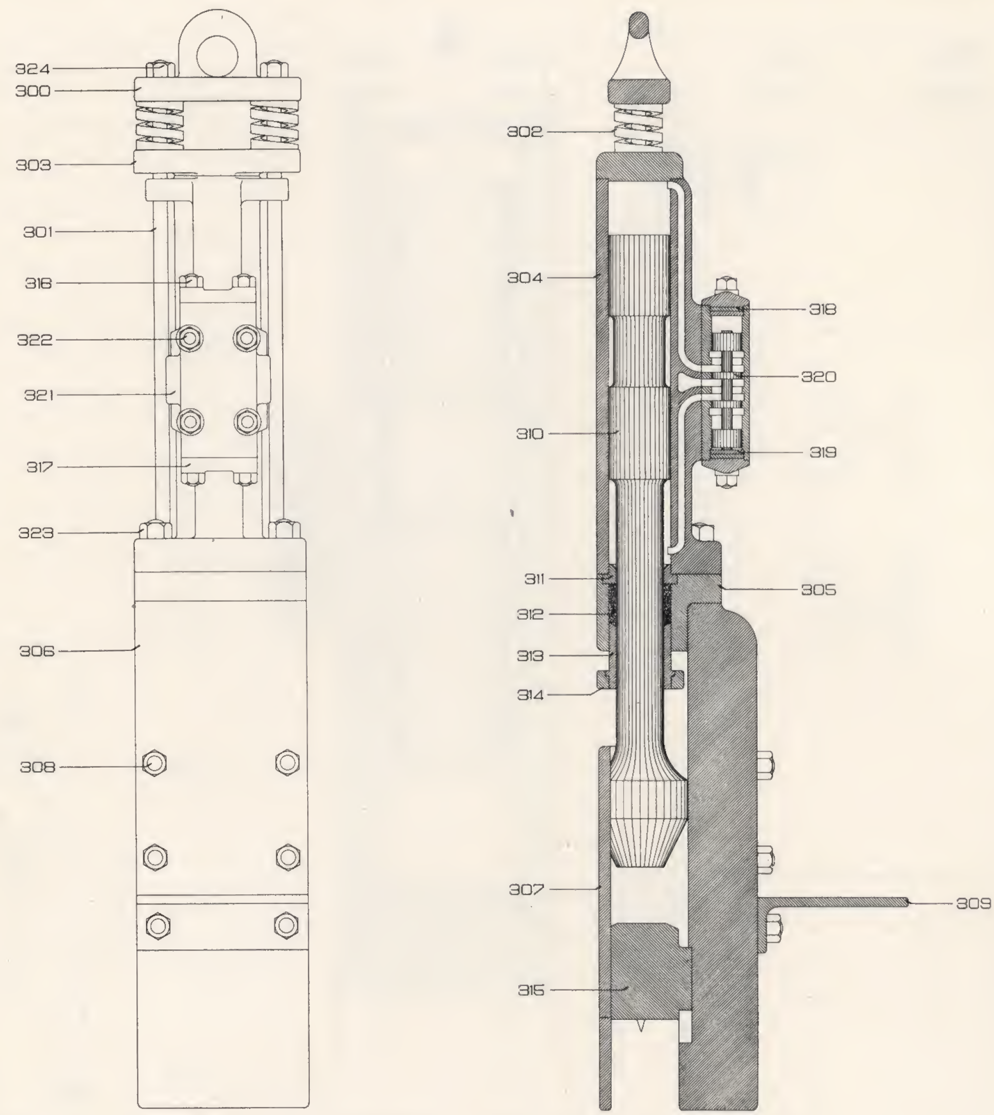


PARTS LIST FOR NO. 2 PILE HAMMER

No. 2 Pile Hammer Code Word—OPLET

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
200	Top Head	1	ABMAY	212	Chest Cover Stud and Nut	4	ABOCY
201	Tie Rod Nut	4	ABMEZ	213	Chest Cover	2	ABOGN
202	Tie Rod Washer	4	ABMIA	214	Valve Washer	2	ABOHF
203	Top Cylinder	1	ABMOB	216	Valve	1	ABOSP
204	Middle Cylinder	1	ABMUC	217	Valve Chest	1	ABOTZ
205	Bottom Cylinder	1	ABNAZ	218	Chest Stud and Nut	4	ABOVA
206	Bottom Head	1	ABNEG	219	Pulling Plug	1	ABOWE
207	Anvil	1	ABNIB	220	Driving Plug	1	ABOXI
209	Tie Rod (right and left)	4	ABNOC	222	Valve Bushing (2 pieces)	1	ABPAB
210	Ram	1	ABNUD	223	Lifting Handles	2	ABPEC
211	Piston Ring	2	ABOBU				

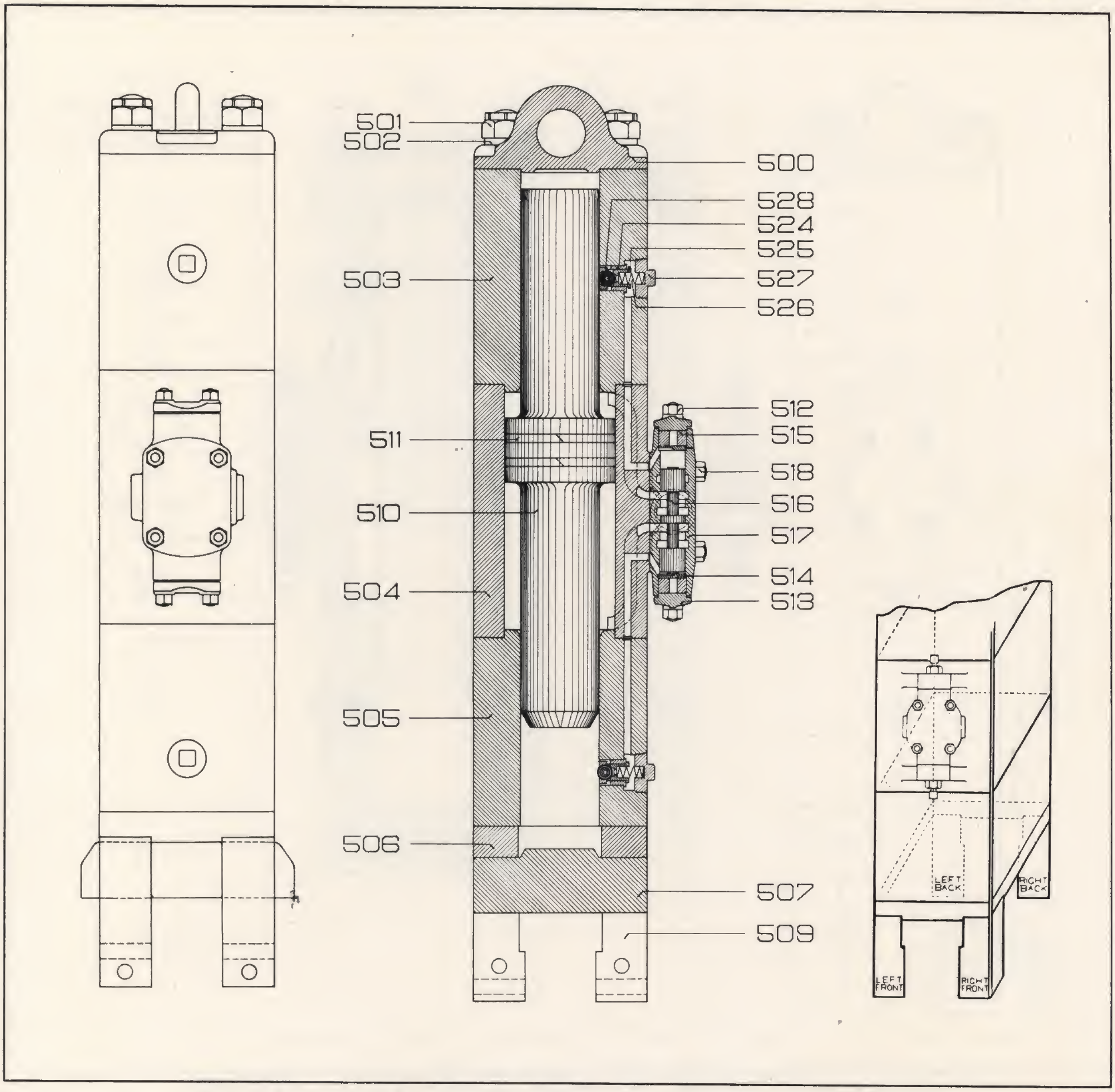
NOTE: When ordering Tie Rods (part No. 209) be sure to specify whether right or left side, front or back, (looking toward valve chest). See diagram above.



PARTS LIST FOR NO. 3 PILE HAMMER

No. 3 Pile Hammer Code Word—OPLIX

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
300	Bail	1	ABTAE	312	Piston Rod Packing, ⅜ sq.—4 rings	....	ABUSK
301	Side Rod	2	ABTEF	313	Packing Sleeve—2 pieces	1	ABUZN
302	Top Head Spring	2	ABTIG	314	Packing Sleeve Gland	1	ABVAH
303	Top Head	1	ABTOH	315	Anvil	1	ABVEI
304	Cylinder	1	ABUBA	316	Chest Cover Stud and Nut	4	ABVIK
305	Bottom Head	1	ABUCE	317	Chest Cover	2	ABVOL
306	Base Block	1	ABUDI	318	Valve Buffer	2	ABWAG
307	Base Block Cap	1	ABUFO	319	Valve Washer	2	ABWEK
308	Base Block Bolt and Nut	6	ABUGU	320	Valve	1	ABWIL
309	Step	1	ABUHY	321	Valve Chest	1	ABXAK
310	Ram	1	ABULT	322	Chest Stud and Nut	4	ABXEL
311	Bottom Head Split Ring—2 pieces	1	ABUMP	323	Cylinder Stud and Nut	4	ABXIM
				324	Side Rod Nut	4	ABXON

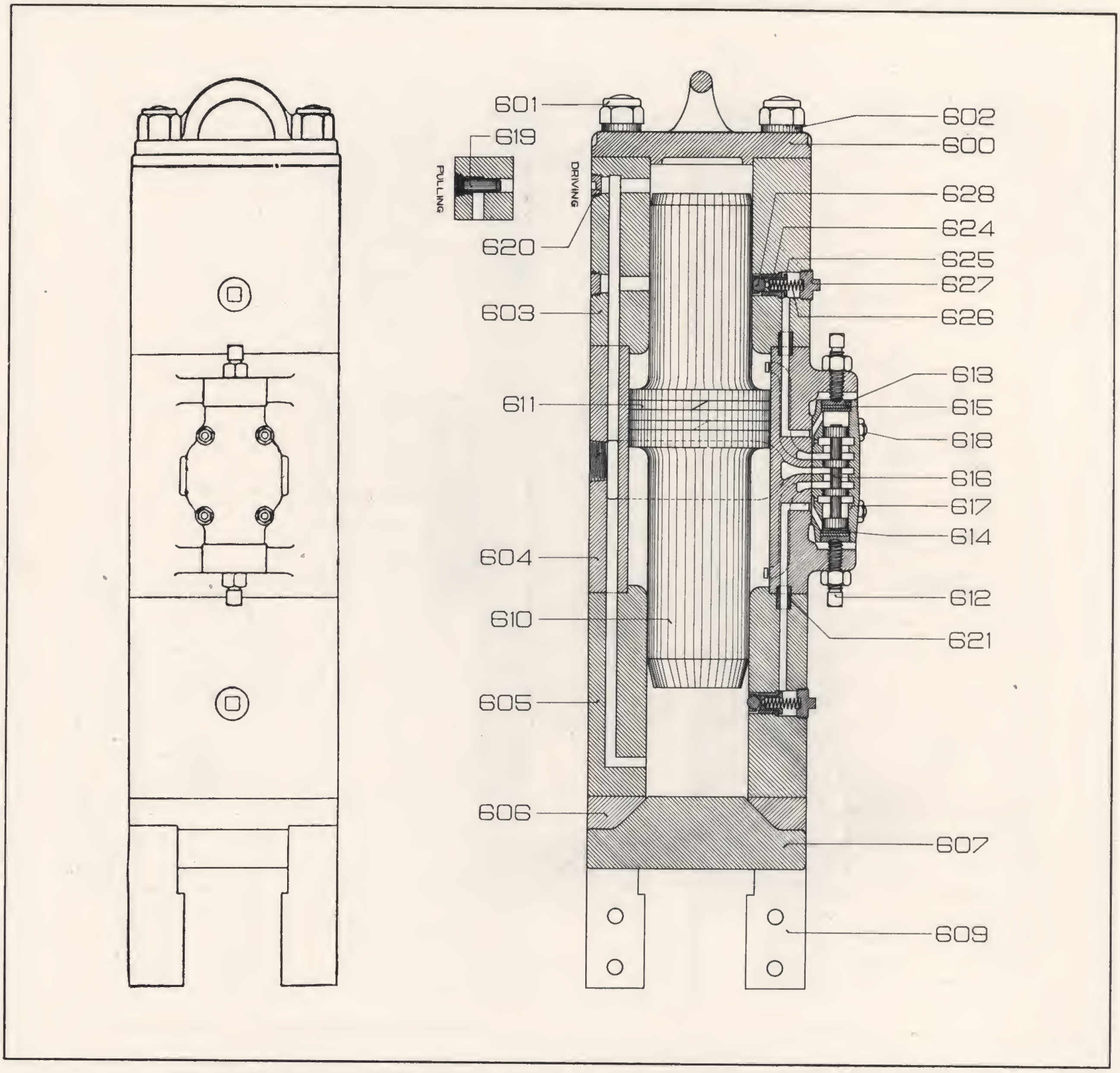


PARTS LIST FOR NO. 5 PILE HAMMER

No. 5 Pile Hammer Code Word—OPLUZ

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
500	Top Head	1	ACABT	513	Chest Cover	2	ACBUK
501	Tie Rod Nut	4	ACACS	514	Valve Washer	2	ACCAN
502	Tie Rod Washer	4	ACAFZ	515	Valve Buffer	2	ACCEO
503	Top Cylinder	1	ACAGA	516	Valve	1	ACCIP
504	Middle Cylinder	1	ACAKI	517	Valve Chest	1	ACCOR
505	Bottom Cylinder	1	ACALO	518	Chest Stud and Nut	4	ACCUS
506	Bottom Head	1	ACANY	524	Valve Cage	2	ACDAF
507	Anvil	1	ACARB	525	Movable Valve Seat	2	ACDEP
509	Tie Rod (2 right and 2 left)	4	ACBAM	526	Spring	2	ACDIR
510	Ram	1	ACBEN	527	Spring Stop	2	ACDOS
511	Piston Ring	2	ACBIC	528	Steel Ball	2	ACDUT
512	Chest Cover Stud and Nut	4	ACBOP				

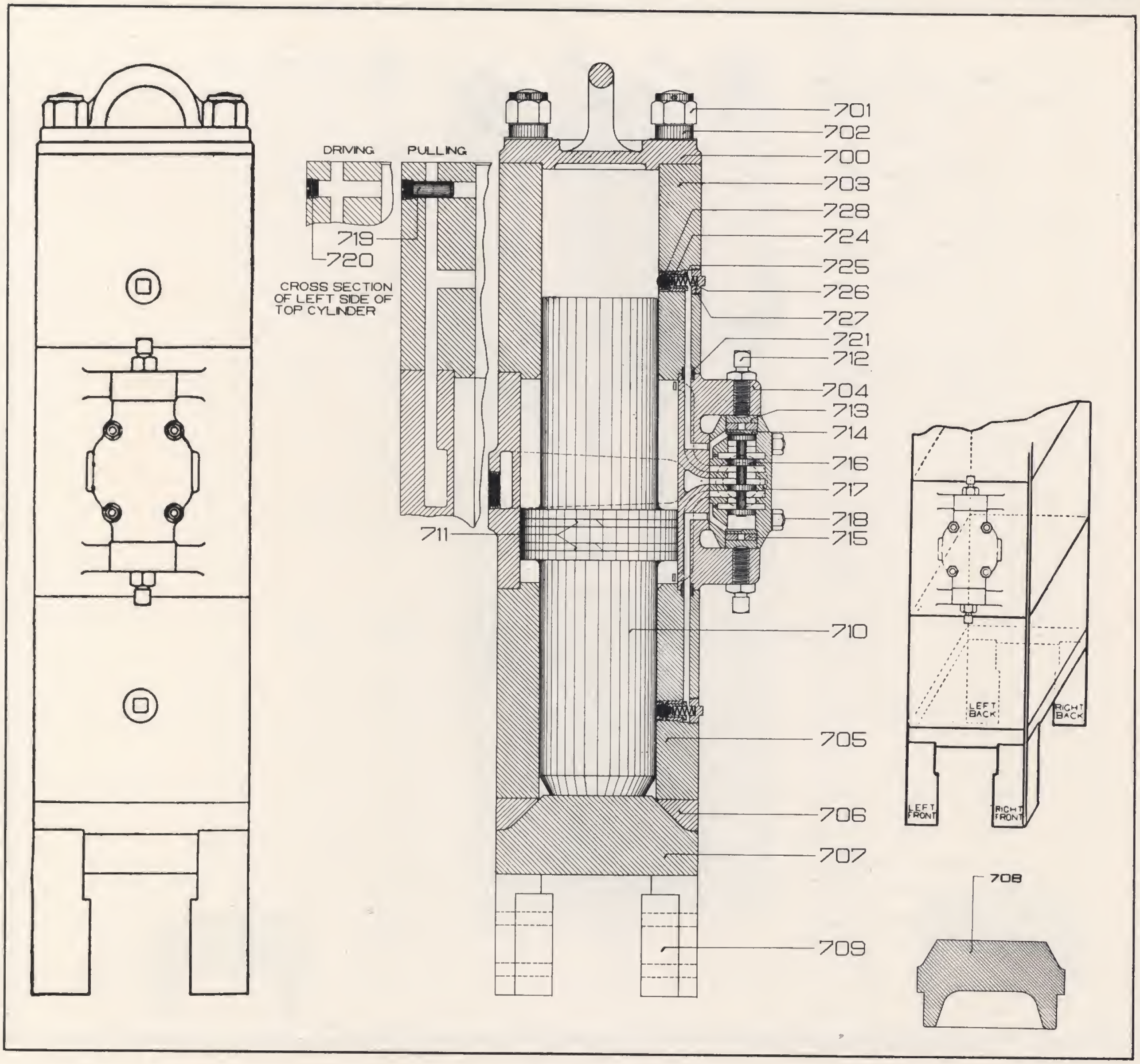
NOTE: When ordering Tie Rods (part No. 509) be sure to specify whether right or left side, front or back, (looking toward valve chest).



PARTS LIST FOR NO. 6 PILE HAMMER

No. 6 Pile Hammer Code Word—OPMAT

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
600	Top Head	1	ACFAP	614	Valve Washer	2	ACHUZ
601	Tie Rod Nut	4	ACFER	615	Valve Buffer	2	ACICK
602	Tie Rod Washer	4	ACFIS	616	Valve	1	ACIDZ
603	Top Cylinder	1	ACFOT	617	Valve Chest	1	ACIFT
604	Middle Cylinder	1	ACFUX	618	Chest Stud and Nut	4	ACIPA
605	Bottom Cylinder	1	ACGAR	619	Pulling Plug	1	ACIRE
606	Bottom Head	1	ACGES	620	Driving Plug	1	ACISI
607	Anvil	1	ACGIT	621	Dowel	2	ACITO
609	Tie Rod (interchangeable)	4	ACGOX	624	Valve Cage	2	ACIWY
610	Ram	1	ACHAS	625	Movable Valve Seat	2	ACIXS
611	Piston Ring	2	ACHET	626	Spring	2	ACJAT
612	Chest Cover Set Screw and Nut	2	ACHIX	627	Spring Stop	2	ACJEX
613	Chest Cover	2	ACHOY	628	Steel Ball	2	ACJIH

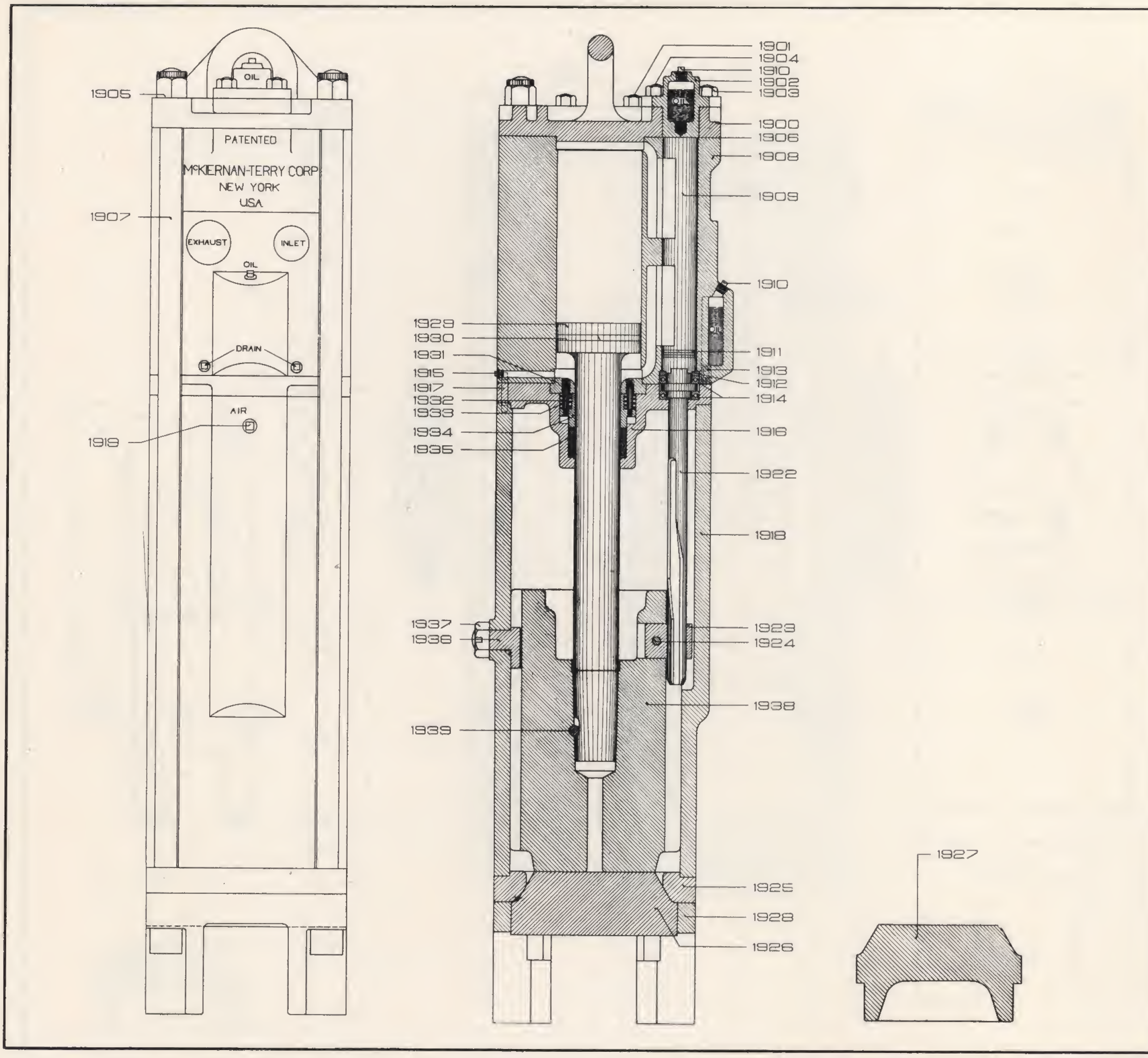


PARTS LIST FOR NO. 7 PILE HAMMER

No. 7 Pile Hammer Code Word—OPMEX

No.	Name	No. Req.	Code Word	No.	Name	No. Req.	Code Word
700	Top Head	1	ACLEZ	713	Chest Cover	2	ACNUF
701	Tie Rod Nut	4	ACLIA	714	Valve Washer	2	ACOBO
702	Tie Rod Washer	4	ACLOB	715	Valve Buffer	2	ACOCU
703	Top Cylinder	1	ACLUC	716	Valve	1	ACODY
704	Middle Cylinder	1	ACMAZ	717	Valve Chest	1	ACOKS
705	Bottom Cylinder	1	ACMEG	718	Chest Stud and Nut	4	ACOLM
706	Bottom Head	1	ACMIB	719	Pulling Plug	1	ACOPH
707	Anvil (flat)	1	ACMOC	720	Driving Plug	1	ACORF
708	Anvil (bell bottom)	1	ACMUD	721	Dowel	2	ACOST
709	Tie Rod (2 right and 2 left)	4	ACNAB	724	Valve Cage	2	ACOWA
710	Ram	1	ACNEC	725	Movable Valve Seat	2	ACOXE
711	Piston Ring	2	ACNID	726	Spring	2	ACOZI
712	Chest Cover Set Screw and Nut	2	ACNOE	727	Spring Stop	2	ACPED
				728	Steel Ball	2	ACPIE

NOTE: When ordering Tie Rods (part No. 709) be sure to specify whether right or left side, front or back, (looking toward valve chest). See diagram above.

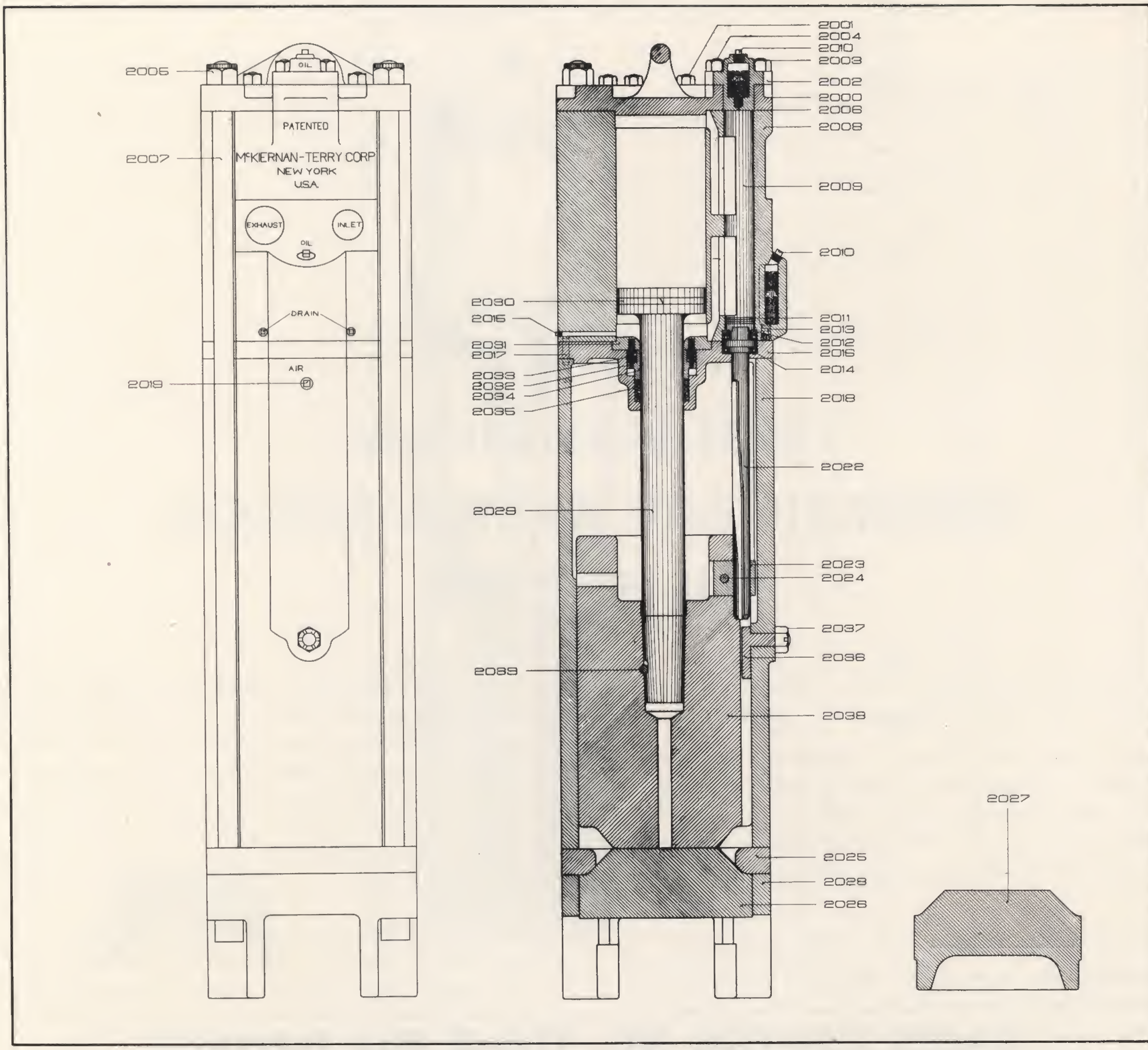


PARTS LIST FOR NO. 9-B-3 PILE HAMMER

No. 9-B-3 Pile Hammer Code Word—OPNOD

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
1900	Top Head	1	AFJIA	1919	Air Inlet Plug	1	AFNEB
1901	Top Head Stud and Nut	6	AFJOB	1922	Cam Rod	1	AFNUH
1902	Valve Cover	1	AFJUC	1923	Cam Throw	1	AFOBE
1903	Valve Cover Stud and Nut (Front)	2	AFKAZ	1924	Cam Throw Taper Pin	1	AFOCI
1904	Valve Cover Stud and Nut (Rear)	2	AFKEG	1925	Bottom Head	1	AFODO
1905	Tie Rod Nut	4	AFKIB	1926	Anvil (Flat)	1	AFOFU
1906	Top Head Gasket	1	AFKOC	1927	Anvil (Bell Bottom)	1	AFOGY
1907	Tie Rod	4	AFKUD	1928	Anvil Retainer—2 pieces	1	AFOLK
1908	Top Cylinder	1	AFLAB	1929	Piston	1	AFONS
1909	Valve	1	AFLEC	1930	Piston Ring	1	AFORL
1910	Oil Plug	2	AFLID	1931	Gland Ring—2 pieces	1	AFOZA
1911	Valve Ring	2	AFLOE	1932	Gland Spring Holder Pin	6	AFPAE
1912	Cam Rod Bearing Thrust Washer	1	AFLUF	1933	Gland Spring	6	AFPEF
1913	Oil Pocket Cap	2	AFMAC	1934	Gland Spring Holder—2 pieces	1	AFPIG
1914	Cam Rod Bearing	2	AFMED	1935	Packing	....	AFPOH
1915	Drain Plug	3	AFMIE	1936	Ram Guide	1	AFRAJ
1916	Intermediate Head	1	AFMOF	1937	Ram Guide Nut	1	AFREI
1917	Dowel Pin	2	AFMUG	1938	Ram	1	AFRIK
1918	Bottom Cylinder	1	AFNAD	1939	Ram Taper Pin	1	AFROL

NOTE: Do not use more than 4 rings of ⅝-inch square packing

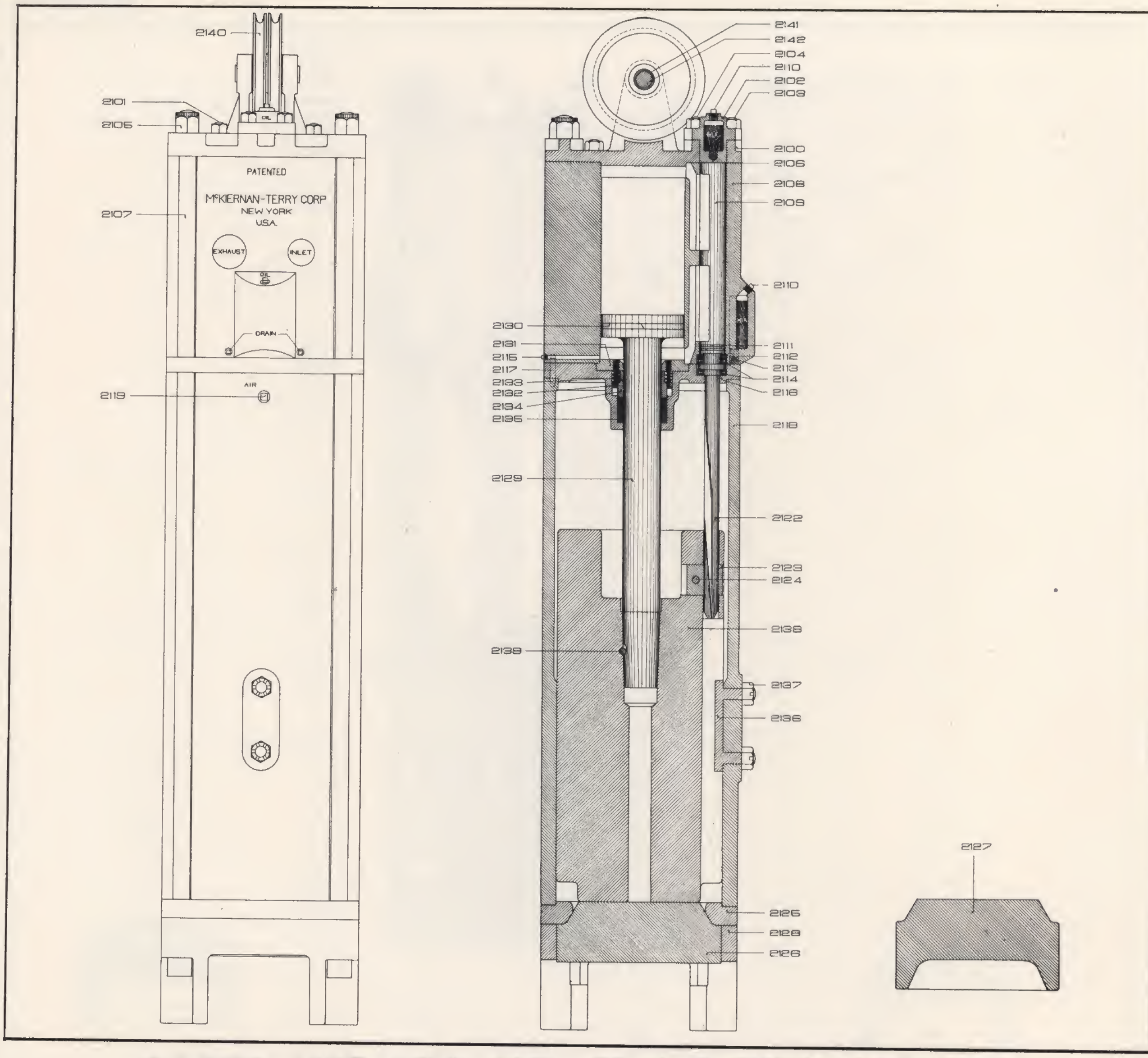


PARTS LIST FOR NO. 10-B-3 PILE HAMMER

No. 10-B-3 Pile Hammer Code Word—OPNIZ

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
2000	Top Head	1	AFTAK	2019	Air Inlet Plug	1	AFVUP
2001	Top Head Stud and Nut	6	AFTEL	2022	Cam Rod	1	AFWIC
2002	Valve Cover	1	AFTIM	2023	Cam Throw	1	AFWOP
2003	Valve Cover Stud and Nut (Front)	2	AFTON	2024	Cam Throw Taper Pin	1	AFWUK
2004	Valve Cover Stud and Nut (Rear)	2	AFTUR	2025	Bottom Head	1	AFXAN
2005	Tie Rod Nut	4	AFUBZ	2026	Anvil (Flat)	1	AFXEO
2006	Top Head Gasket	1	AFUFA	2027	Anvil (Bell Bottom)	1	AFXIP
2007	Tie Rod	4	AFUGE	2028	Anvil Retainer	1	AFXOR
2008	Top Cylinder	1	AFUHI	2029	Piston	1	AFXUS
2009	Valve	1	AFUKO	2030	Piston Ring	1	AFZAG
2010	Oil Plug	2	AFULU	2031	Gland Ring—2 pieces	1	AFZEK
2011	Valve Ring	2	AFUMY	2032	Gland Spring Holder Pin	6	AFZIL
2012	Cam Rod Bearing Thrust Washer	1	AFUNK	2033	Gland Spring	6	AFZOM
2013	Oil Pocket Cap	2	AFURD	2034	Gland Spring Holder—2 pieces	1	AFZUN
2014	Cam Rod Bearing	2	AFUSH	2035	Packing	....	AGAHK
2015	Drain Plug	3	AFVAL	2036	Ram Guide	1	AGALA
2016	Intermediate Head	1	AFVEM	2037	Ram Guide Nut	1	AGAME
2017	Dowel Pin	2	AFVIN	2038	Ram	1	AGANI
2018	Bottom Cylinder	1	AFVOK	2039	Ram Taper Pin	1	AGAPO

NOTE: Do not use more than 4 rings of ⅝-inch square packing.



PARTS LIST FOR NO. 11-B-3 PILE HAMMER

No. 11-B-3 Pile Hammer Code Word—OPNEY

Part No.	Name of Part	No. Req.	Code Word	Part No.	Name of Part	No. Req.	Code Word
2100	Top Head	1	AFAMI	2122	Cam Rod	1	AFDIT
2101	Top Head Stud and Nut	6	AFANO	2123	Cam Throw	1	AFDUT
2102	Valve Cover	1	AFARY	2124	Cam Throw Taper Pin	1	AFFUZ
2103	Valve Cover Stud and Nut (Front)	2	AFASB	2125	Bottom Head	1	AFBIR
2104	Valve Cover Stud and Nut (Rear)	2	AFHIZ	2126	Anvil (Flat)	1	AFBOS
2105	Tie Rod Nut	4	AFAPU	2127	Anvil (Bell Bottom)	1	AFBUT
2106	Top Head Gasket	1	AFHOD	2128	Anvil Retainer	1	AFHAX
2107	Tie Rod	4	AFCAP	2129	Piston	1	AFCER
2108	Top Cylinder	1	AFAZT	2130	Piston Ring	1	AFCIS
2109	Valve	1	AFDAR	2131	Gland Ring—2 pieces	1	AFGIH
2110	Oil Plug	2	AFEGT	2132	Gland Spring Holder Pin	6	AFGOZ
2111	Valve Ring	2	AFDES	2133	Gland Spring	6	AFGEX
2112	Cam Rod Bearing Thrust Washer	1	AFDOX	2134	Gland Spring Holder—2 pieces	1	AFGAT
2113	Oil Pocket Cap	2	AFEHZ	2135	Packing	....	AFCOT
2114	Cam Rod Bearing	2	AFHUB	2136	Ram Guide	1	AFETU
2115	Drain Plug	3	AFELS	2137	Ram Guide Nut	2	AFEVY
2116	Intermediate Head	1	AFBAF	2138	Ram	1	AFCUX
2117	Dowel Pin	2	AFESO	2139	Ram Taper Pin	1	AFIBK
2118	Bottom Cylinder	1	AFBEP	2140	Sheave	2	AFFAS
2119	Air Inlet Plug	1	AFENA	2141	Sheave Bushing	2	AFICF
				2142	Sheave Shaft	1	AFIDS

NOTE: Do not use more than 4 rings of ⅝-inch square packing.

McKIERNAN-TERRY DOUBLE-ACTING PILE HAMMERS ON THE JOB

The pages immediately following will show you photographs of a few of the innumerable pile-driving projects which McKiernan-Terry Double-Acting Pile Hammers have helped make successful. They picture work done with McKiernan-Terry Hammers ranging from the 2-foot high 105-pound McKiernan-Terry No. 0 up to the 11-foot high 14,000-pound McKiernan-Terry No. 11-B-3.

The settings of these pictures show not only domestic scenes but also foreign and distant places, such as Europe, South America, Egypt, India, Japan, etc.

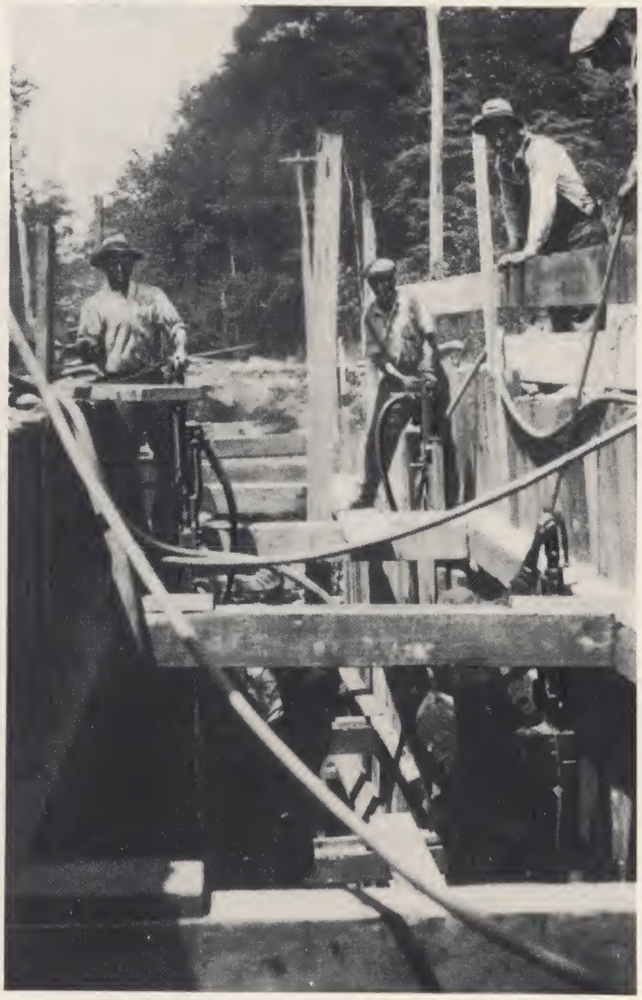
Furthermore, the pile-driving jobs pictured are similarly varied, from driving light 2-inch by 8-foot wood sheeting up to reinforced concrete piles 90 feet in length, and in some instances 24 inches in diameter. Also steel pipe piles 36 inches in diameter and up to 110 feet in length, as well as tubular steel caissons 7½ feet in diameter — to mention merely a few shown.

Unusual pile-hammer uses will show you, for example, a hammer operating horizontally — actually on its back — see page 35; pile hammers used to raze buildings — pages 36 and 37; six big double-acting pile hammers pounding away at one time on the same project — page 6.

But the best part — the practical part — of this collection of pictures is that they show what important work McKiernan-Terry Double-Acting Pile Hammers have been doing all these years. You will see many jobs with which you may be already familiar. And you will probably see pile hammer applications which may be useful to know about in handling difficult pile-driving problems of your own.

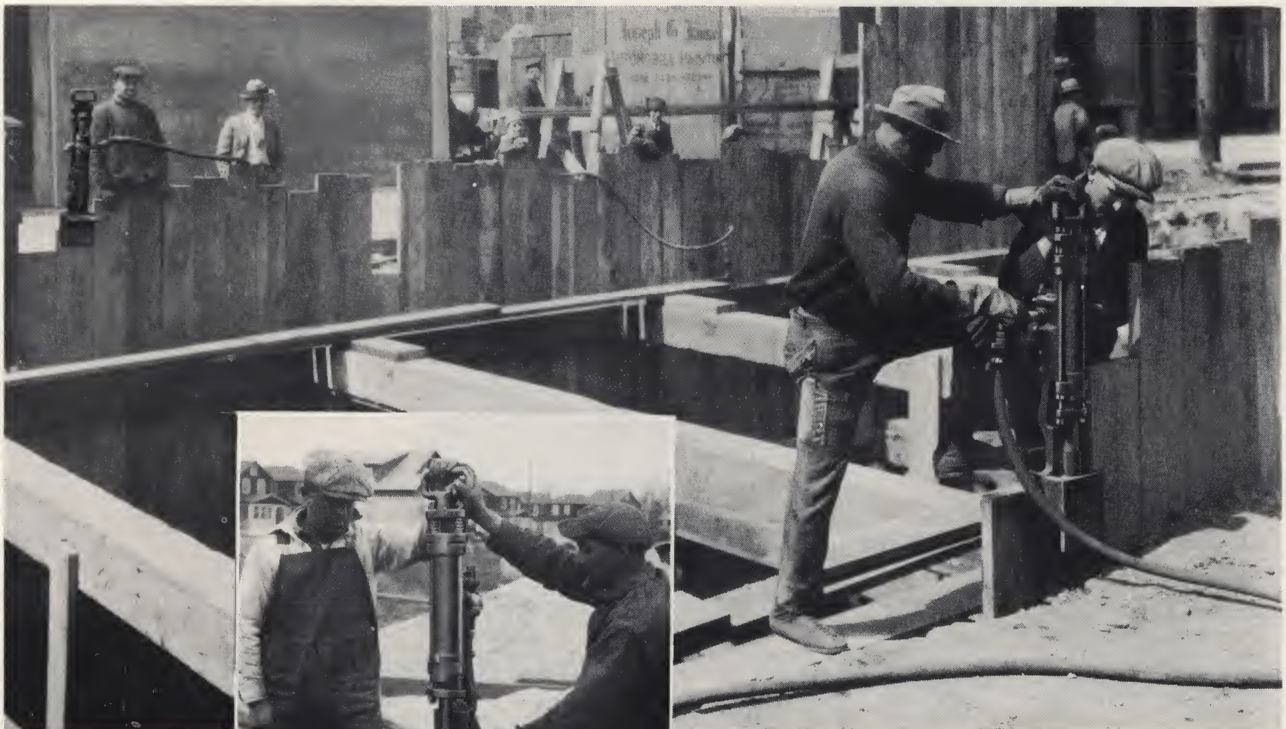
HANDY TIME-SAVERS DRIVING SMALL PILES

Brooklyn, N. Y. One of five McKiernan-Terry No. 0 Double-Acting Pile Hammers driving wood sheeting for the Fulton Street subway, saving time and labor.



Great Neck, N. Y. McKiernan-Terry No. 0 and No. 1 Double-Acting Pile Hammers used to drive wood sheeting in laying a sewer. A total of 7,000 feet of 2-inch x 8-inch sheeting 25 to 32 feet long were driven through sandy loam, stone, gravel and clay mixture. The No. 0 Hammer was used to drive an average of 180 pieces 2-inch x 8-inch x 20-feet to a maximum penetration of two feet. Then No. 1 Hammers were substituted.

QUICKER, BETTER AND CHEAPER THAN MAULS



Brooklyn, N. Y. McKiernan-Terry No. 1 and No. 2 Double-Acting Hammers driving wood sheeting on a sewer construction job. The No. 1 Hammer shown in top picture was one of 15 of these labor savers employed, doing the job quicker, better and cheaper than hand driving with mauls would have done it.

ON THE BANKS OF THE THAMES

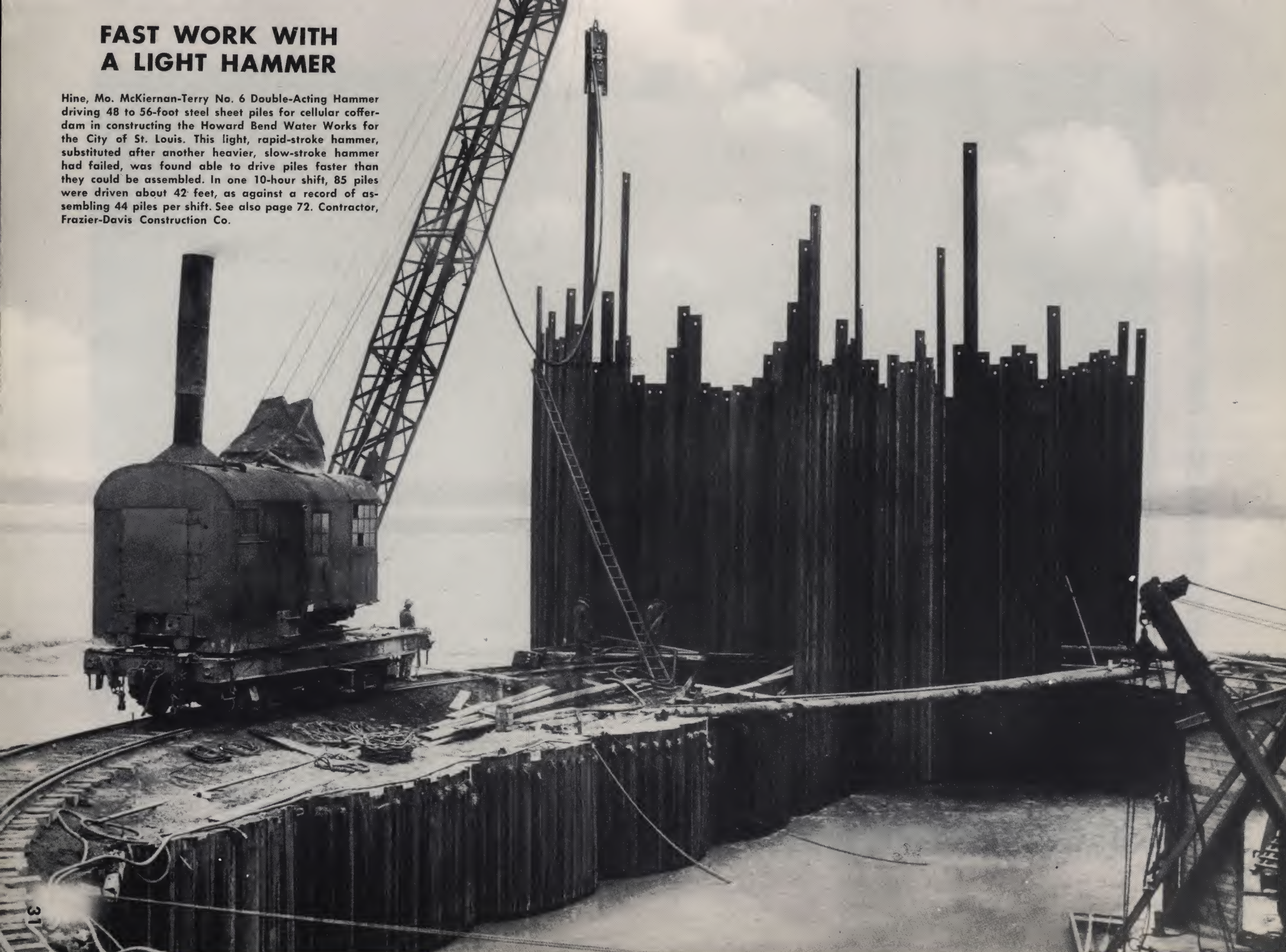
England. McKiernan-Terry No. 3 Double-Acting Hammer driving steel sheet piling for the foundation of a 12,000-ton capacity oil storage tank 120 feet in diameter. Sheet piling used to form a complete ring around the foundation to prevent soft ground from spreading under the weight of tank and contents.

DRIVING SHEET PILES WITHOUT A DERRICK

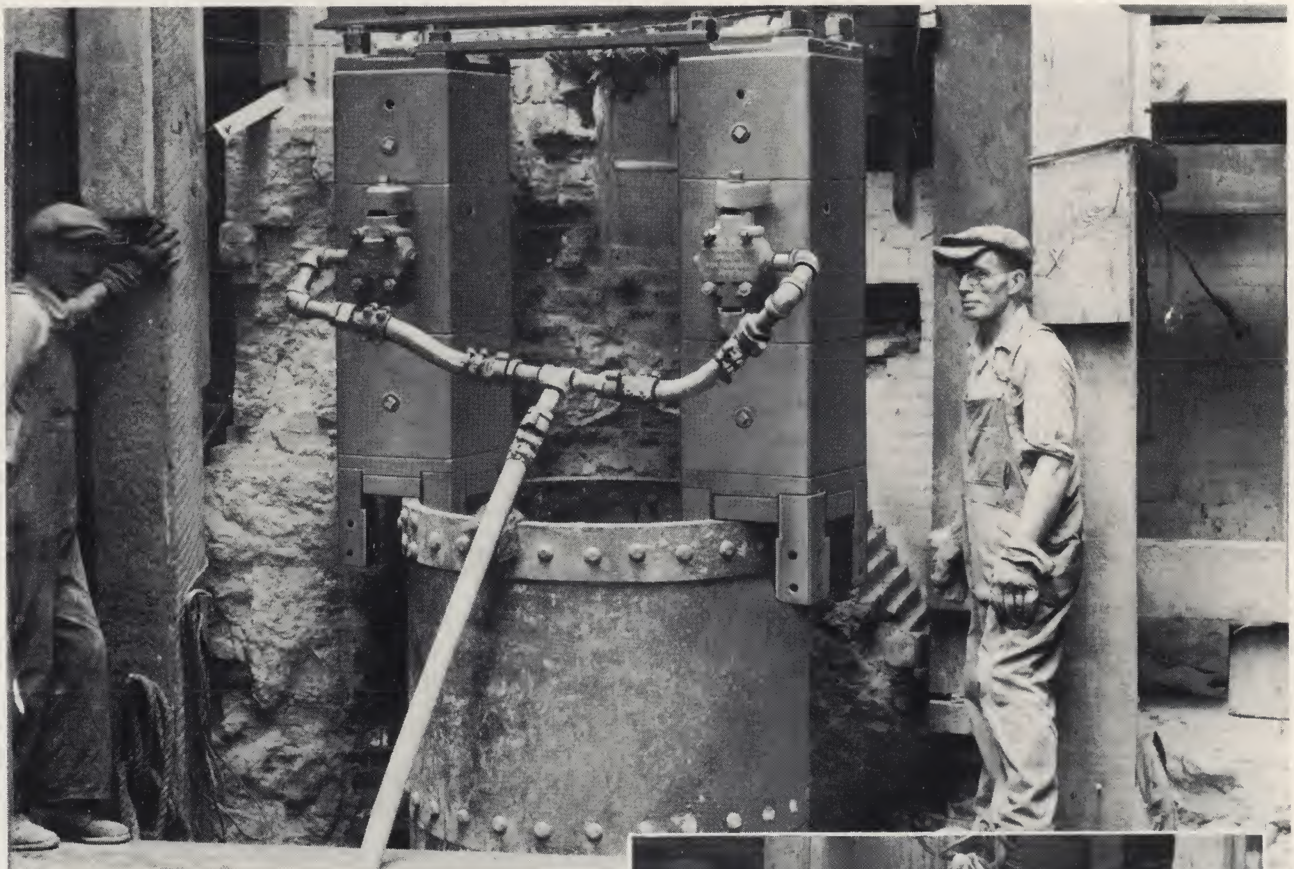
New York City. Four McKiernan-Terry No. 5 Double-Acting Hammers were used to drive 9-inch steel sheet piling for cofferdams in the construction of the Savoy Plaza Hotel. A special attachment, sliding in the pile groove, permitted use of the hammers without a derrick. This device provided a firm guide, keeping the hammer directly in line with the piling and permitting every blow to be delivered with full force on the interlock of two sheets driven simultaneously. The cofferdams were excavated later and filled with concrete.

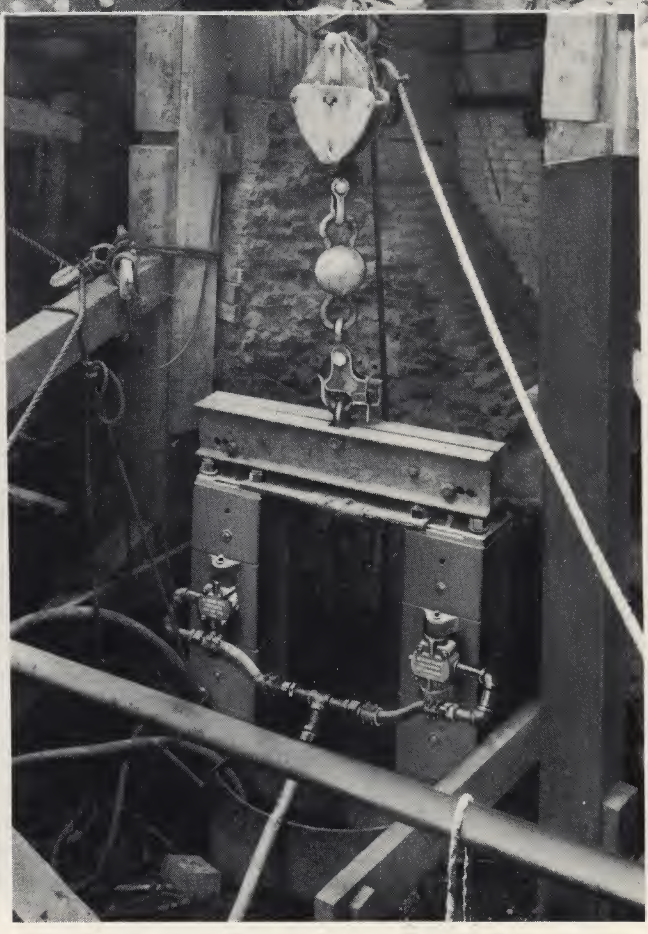
FAST WORK WITH A LIGHT HAMMER

Hine, Mo. McKiernan-Terry No. 6 Double-Acting Hammer driving 48 to 56-foot steel sheet piles for cellular coffer-dam in constructing the Howard Bend Water Works for the City of St. Louis. This light, rapid-stroke hammer, substituted after another heavier, slow-stroke hammer had failed, was found able to drive piles faster than they could be assembled. In one 10-hour shift, 85 piles were driven about 42 feet, as against a record of assembling 44 piles per shift. See also page 72. Contractor, Frazier-Davis Construction Co.



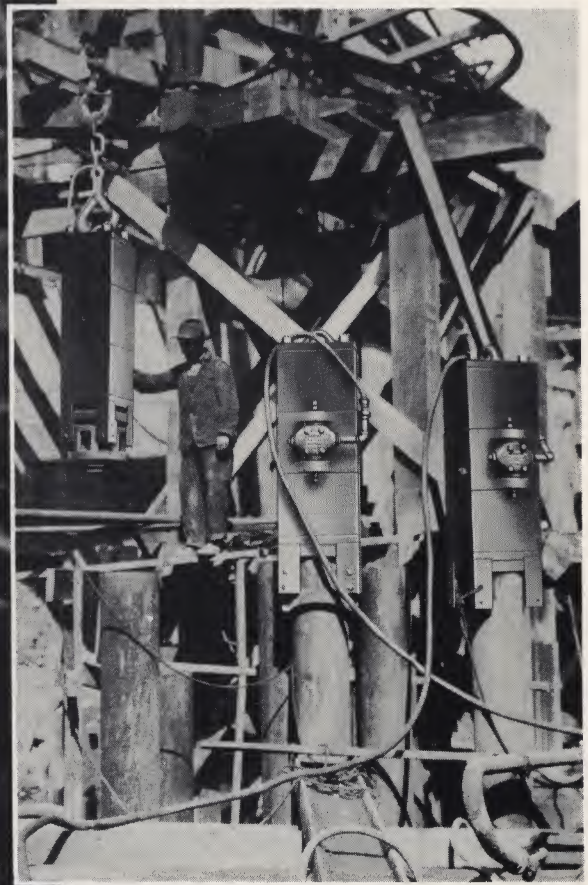
TANDEM TEAM FOR BIG CAISSONS



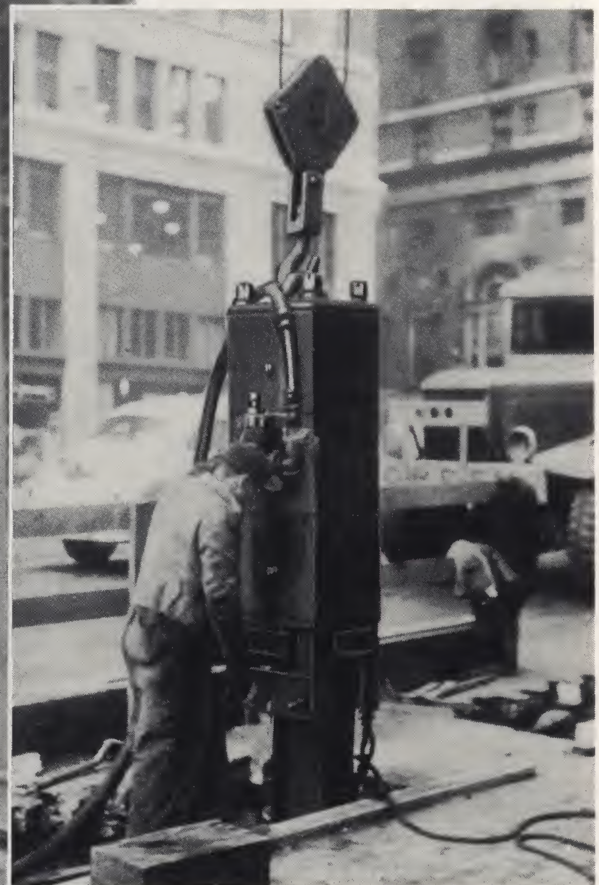


New York City. Bank of the Manhattan Co. Building, Wall Street. McKiernan-Terry No. 6 Double-Acting Hammers driving 44-inch cylinder caissons to 32 feet penetration through sand and hard pan. For 3 of these cylinders, 2 hammers in tandem were used, regulated to strike in unison. The special driving head consisted of a short pipe section with reinforcing bands riveted top and bottom. Picture at lower left looks down into the cylinder. Spencer, White & Prentis, Inc., contractors.

OVER A FOOT PER MINUTE FOR 7½ HOURS



New York City. Dodge Building. One No. 6 and two No. 7 McKiernan-Terry Double-Acting Hammers were used to drive some 300 15-inch open end pipe piles. One of the No. 7 hammers, with a crew of three men, drove 547 feet of pipe in 7½ hours. Photo at left shows pipe being cleaned out with the compressed air used to operate hammers. Spencer, White & Prentis, Inc., contractors.



HELPING TO SPEED RELIEF FOR STRAP HANGERS

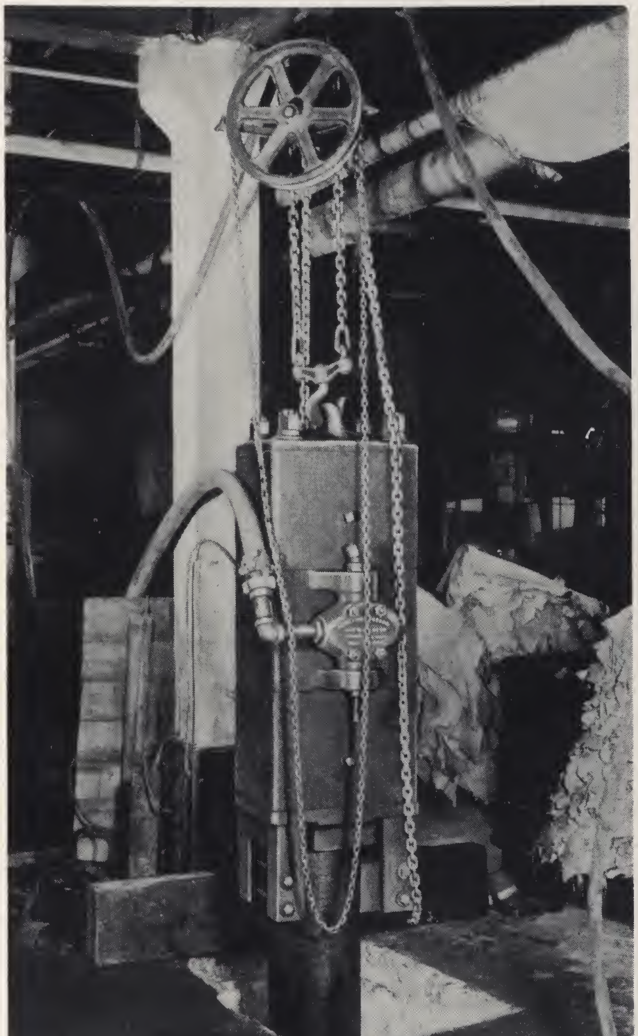
New York City. Extending the Lexington Avenue subway stations. McKiernan-Terry No. 7 Double-Acting Hammer driving steel H-beam supports down through street surface. Johnson, Mason & Hanger, contractors.

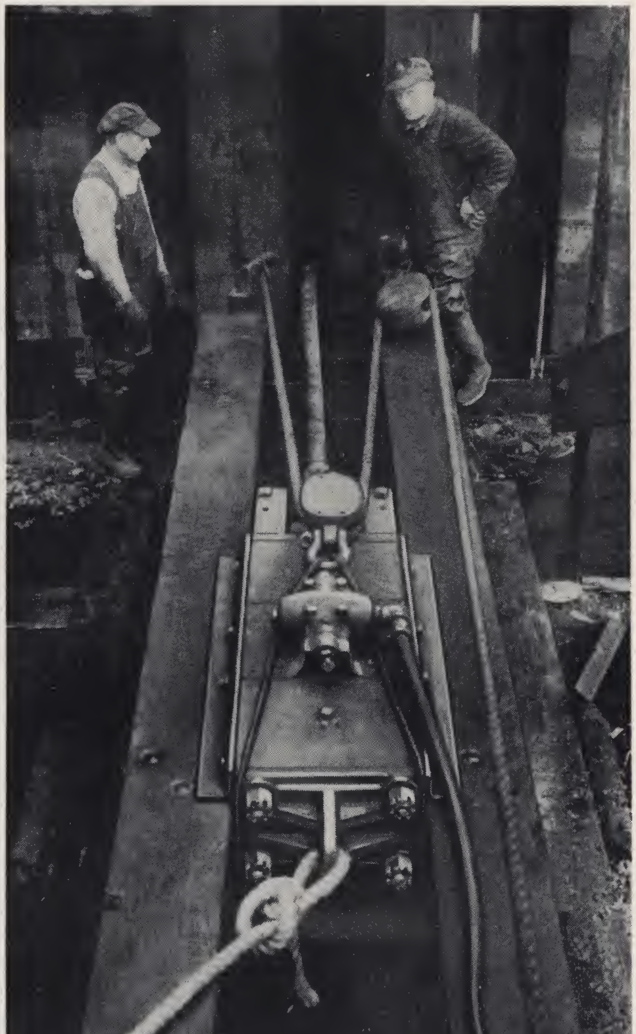
UNUSUAL USES FOR PILE HAMMERS

(Left) Buffalo, N. Y. McKiernan-Terry No. 7 Double-Acting Hammer driving tubular piles for underpinning foundations of the center wing of the Millard Fillmore Hospital. Because of the scant headroom, a special driving rig was devised. A total of 38 piles, varying in length from 15 to 22 feet, were placed, 21 being driven through existing concrete footings. Driven to refusal with the No. 7 Hammer, they were driven to further refusal with a heavier McKiernan-Terry No. 9-B-2 Hammer. Handled by Raymond Concrete Pile Co.

(Below, left) Mid-western war plant. While engaged in vital war work, the building began to show signs of settling. Without interruption of plant operation, McKiernan-Terry No. 7 Double-Acting Hammers were used to install essential underpinnings. With very little headroom, the hammer, suspended by a heavy chain hoist, drove 12-inch tubular steel piles through existing spread footings under the building. After cylinders had been excavated and filled with concrete, structural steel beams and wedges transferred the column loads to these cylinders. Spencer, White & Prentis, Inc., contractors.

(Below, right) Staten Island, N. Y. Installation of new steel bulkhead at the shipyards of Bethlehem Steel Co. Operating in horizontal position, McKiernan-Terry No. 7 Double-Acting Hammers drove 3½-inch steel tie-rods through cinder fill under shipways in operation. The rods connected with steel H-beam deadmen more than 100 feet away. George W. Rogers Construction Co., contractors.





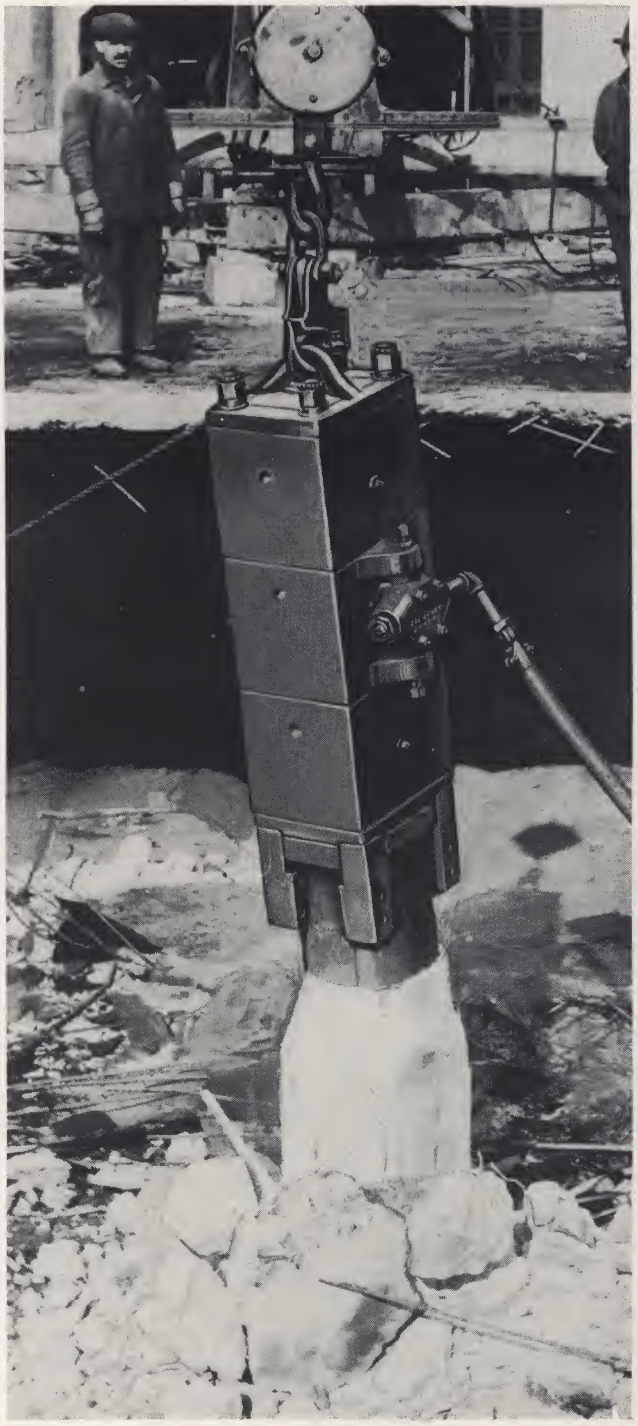
SAVING TIME ON DEMOLITION

New York City. McKiernan-Terry No. 7 Double-Acting Hammer used in demolition of a two-story concrete garage. The hammer was substituted for ordinary wrecking methods because of the need of saving time on the demolition contract. Job was completed in 25 working days—in less time and at less cost than was originally estimated. Previous demolition attempts, using a heavy steel ball, had proved ineffective as well as dangerous. An 18-inch length of pipe, fastened to the anvil, provided a shattering blow. This was removed in tearing down the curtain walls, which were straddled by the legs of the hammer. Spencer, White & Prentis, Inc., contractors.

PLAYING SAFE ON DEMOLITION

(Right) Queensboro, New York City. McKiernan-Terry No. 6 Double-Acting Hammer breaking up masonry in the removal of an old aqueduct to install new sewer. This aqueduct, 13 x 10 x 137 feet, built of brick and concrete, finished outside with concrete blocks, was in such excellent condition that hammer drills were not effective. Explosives could not be used because a temporary water line was too close by. A long 4-inch diameter chisel attached to the hammer, supported by a special cap fitted over the hammer base, broke out the granite and masonry fill in mass.

(Below) New York City. McKiernan-Terry No. 7 Double-Acting Hammer demolishing a concrete column on wrecking job. Spencer, White & Prentis, Inc., contractors.



PILE DRIVING IN THE NILE

Egypt. Constructing the Nag Hammadi Barrage to counter-balance the lowering of the river caused by the Gebel Aulia Dam. McKiernan-Terry No. 7 Double-Acting Hammers, operating from pendulum leads on a floating pile-driving plant, drove 10,000 tons of steel sheet piling for the barrage. The leads traveled along a runway supported by two pile-driving frames mounted on a pontoon. By this means 15 piles could be driven without moving pontoon. The sheet piling ranged from 35 to 40 feet in length and was driven to a penetration of 17 feet. After driving from the pontoons was finished, the hammers were moved ashore to drive the permanent piling for the drained area. Later an inverted No. 7 Hammer pulled the temporary piling, handling some 5,000 piles in 3 weeks. Sir John Jackson, Ltd., contractors.

MODERNIZING A RAILROAD BRIDGE

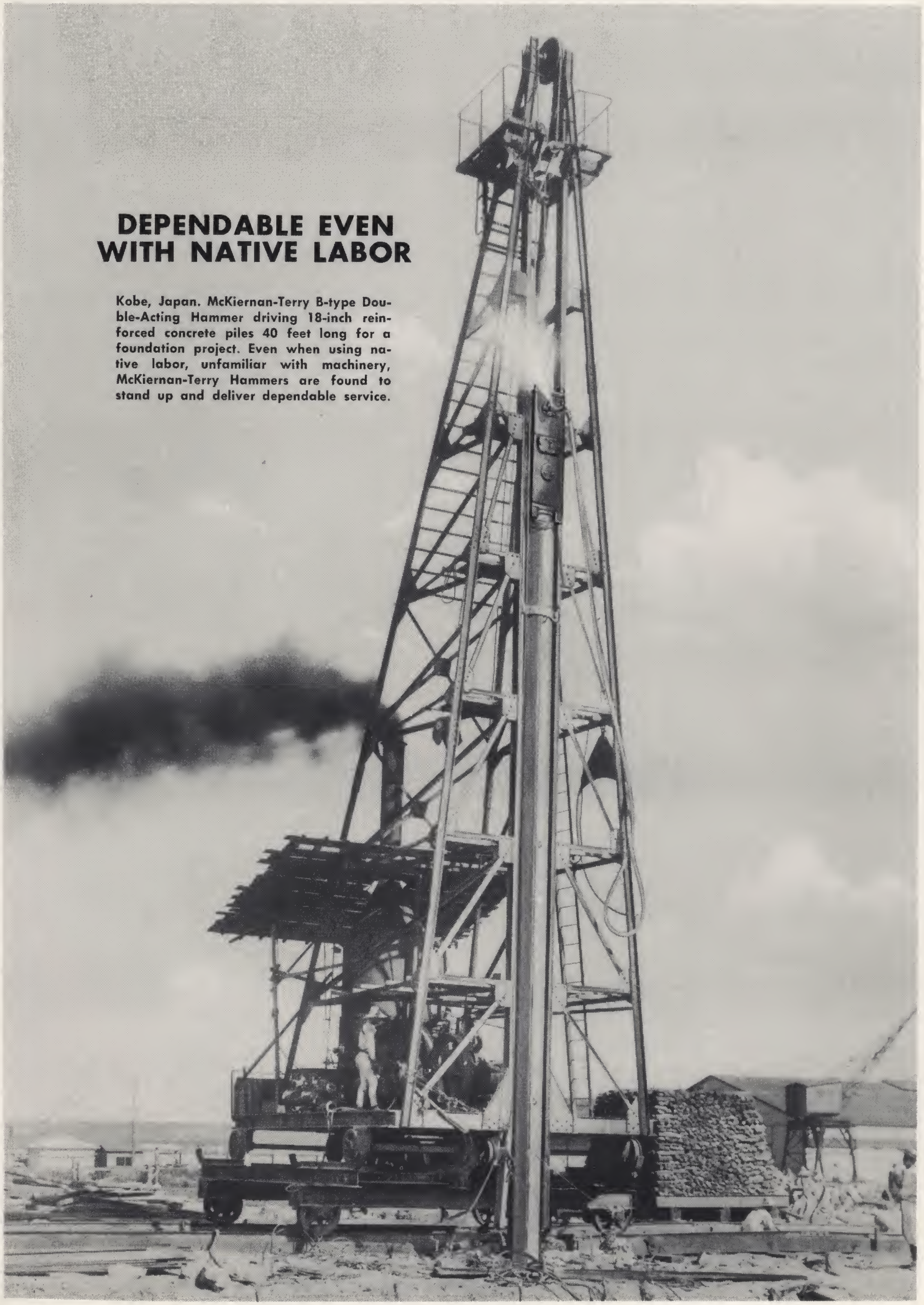
De Cew Falls, near St. Catherines, Ontario. McKiernan-Terry No. 7 Double-Acting Hammer driving pipe piles in the reconstruction of the Canadian National Railways bridge across 12-Mile Creek, completed without interruption of railway traffic. Another McKiernan-Terry Double-Acting Hammer, a No. 10-B-3, shown lying on ground at right in the lower picture, was used for the final feet of driving. Upper picture shows the new, slenderer, concrete-cased piers built around the piles, replacing the previous open frame construction. Contractors, C. A. Pitts, General Contractor, Ltd.

FAST WORK ON PIPE PILES

New York City. McKiernan-Terry No. 7 and No. 9-B-2 Double-Acting Hammers driving pipe piles through fill and old peat bog in constructing a New York Edison Company service station. A total of 13,000 feet of 60-foot piling was driven in 1 week. Spencer, White & Prentis, Inc., contractors.

THIRTY-FOUR HAMMERS ON ONE JOB

Sukkur Sind, India. Several of 12 pile-driving outfits, including McKiernan-Terry Double-Acting Pile Hammers, supplied to the government of India for the construction of the Lloyd Barrage. The McKiernan-Terry equipment included 34 hammers—10 No. 7, 9 No. 9 and 15 No. 9-B-2. Later, 3 more complete outfits were supplied. The hammers were suspended in pendulum leads, swinging from runways between the heads of the frames.

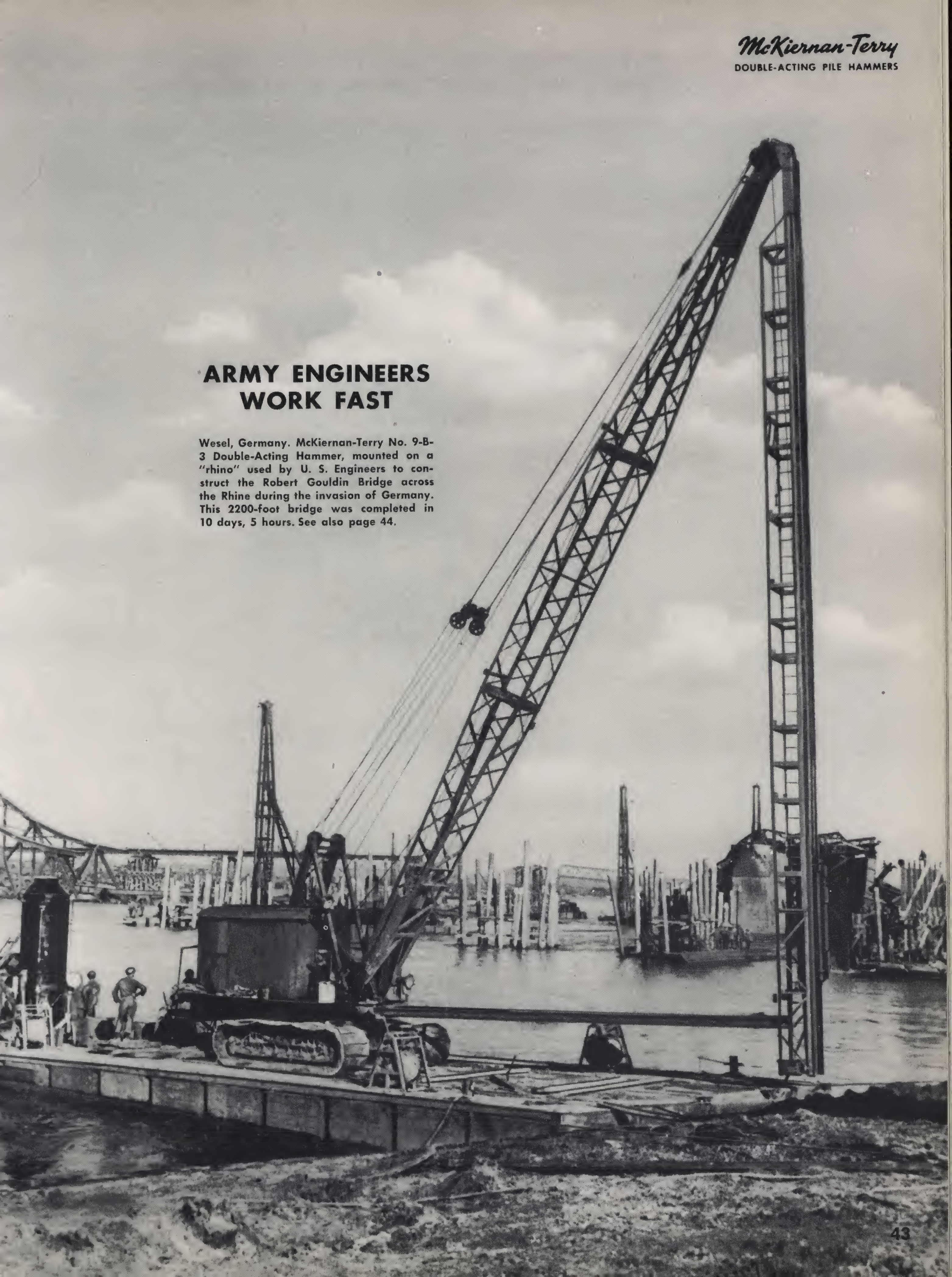


DEPENDABLE EVEN WITH NATIVE LABOR

Kobe, Japan. McKiernan-Terry B-type Double-Acting Hammer driving 18-inch reinforced concrete piles 40 feet long for a foundation project. Even when using native labor, unfamiliar with machinery, McKiernan-Terry Hammers are found to stand up and deliver dependable service.

ARMY ENGINEERS WORK FAST

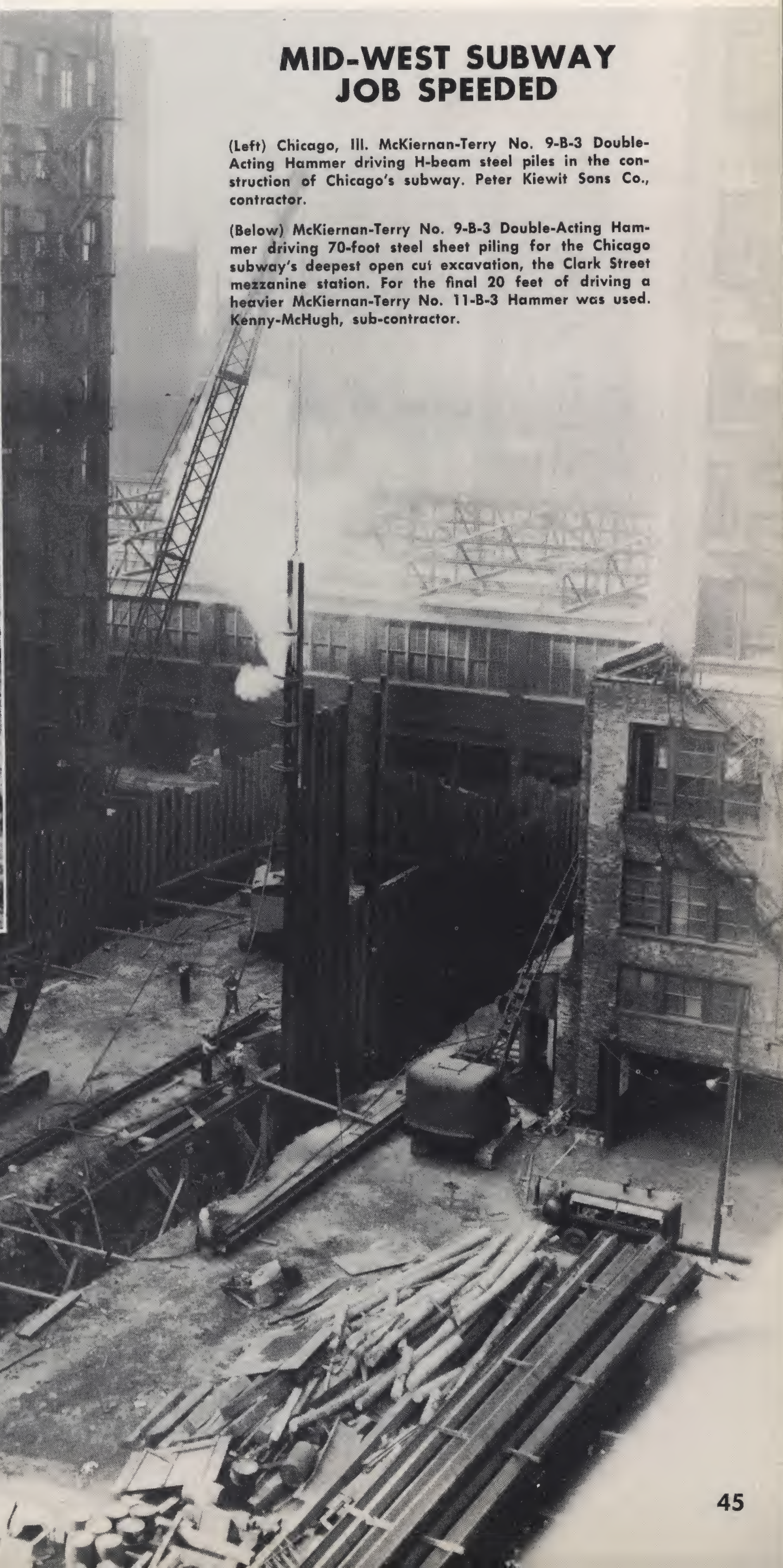
Wesel, Germany. McKiernan-Terry No. 9-B-3 Double-Acting Hammer, mounted on a "rhino" used by U. S. Engineers to construct the Robert Gouldin Bridge across the Rhine during the invasion of Germany. This 2200-foot bridge was completed in 10 days, 5 hours. See also page 44.



RESTORING WARTIME WRECKAGE

Wesel, Germany. Close-up of McKiernan-Terry No. 9-B-3 Double-Acting Hammer shown on preceding page, driving timber piles in constructing the Rhine bridge.

Cherbourg, France. McKiernan-Terry No. 9-B-3 Double-Acting Hammer used by U. S. Engineers in reconstructing the harbor facilities.



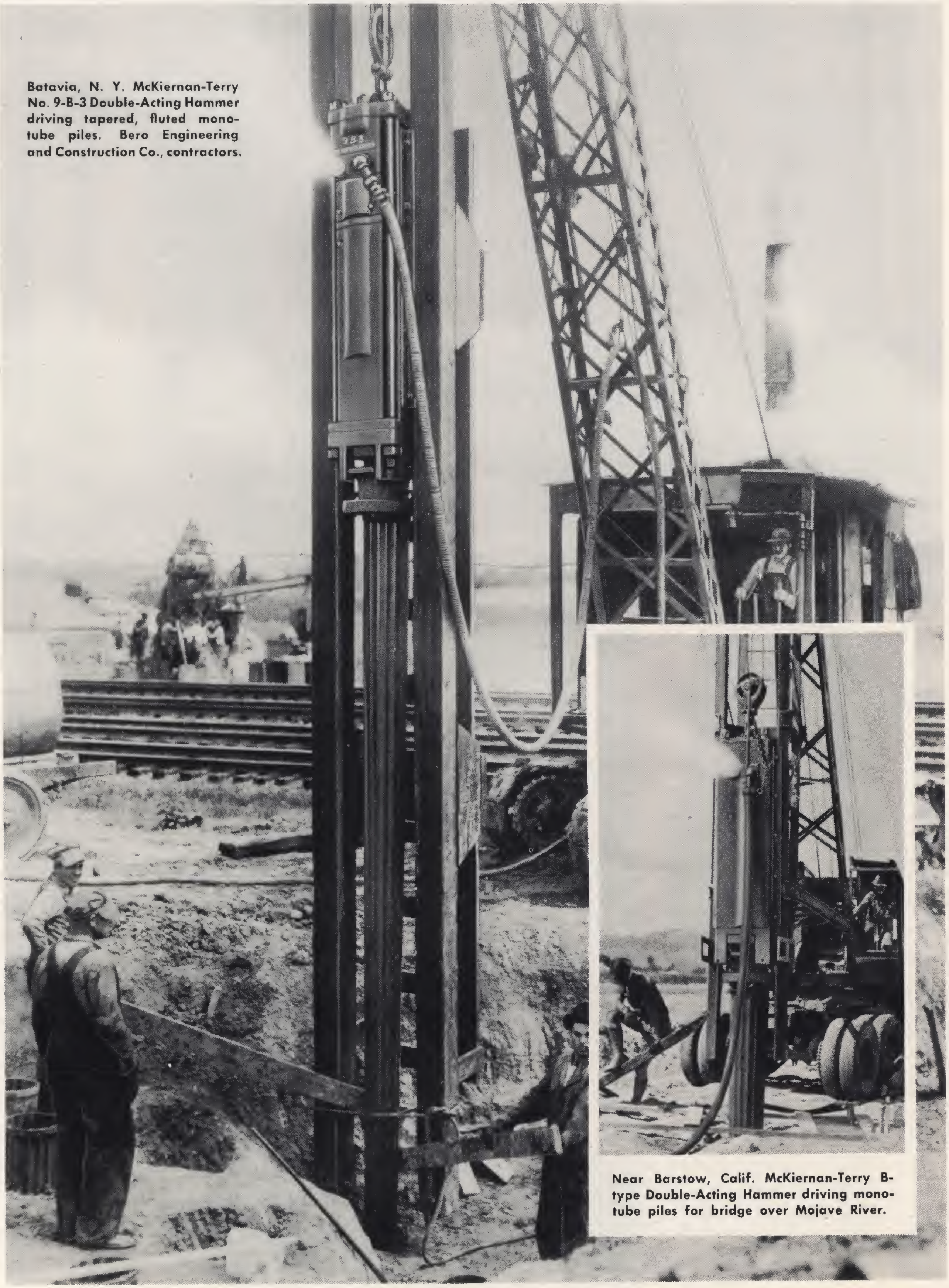
MID-WEST SUBWAY JOB SPEEDED

(Left) Chicago, Ill. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving H-beam steel piles in the construction of Chicago's subway. Peter Kiewit Sons Co., contractor.

(Below) McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving 70-foot steel sheet piling for the Chicago subway's deepest open cut excavation, the Clark Street mezzanine station. For the final 20 feet of driving a heavier McKiernan-Terry No. 11-B-3 Hammer was used. Kenny-McHugh, sub-contractor.

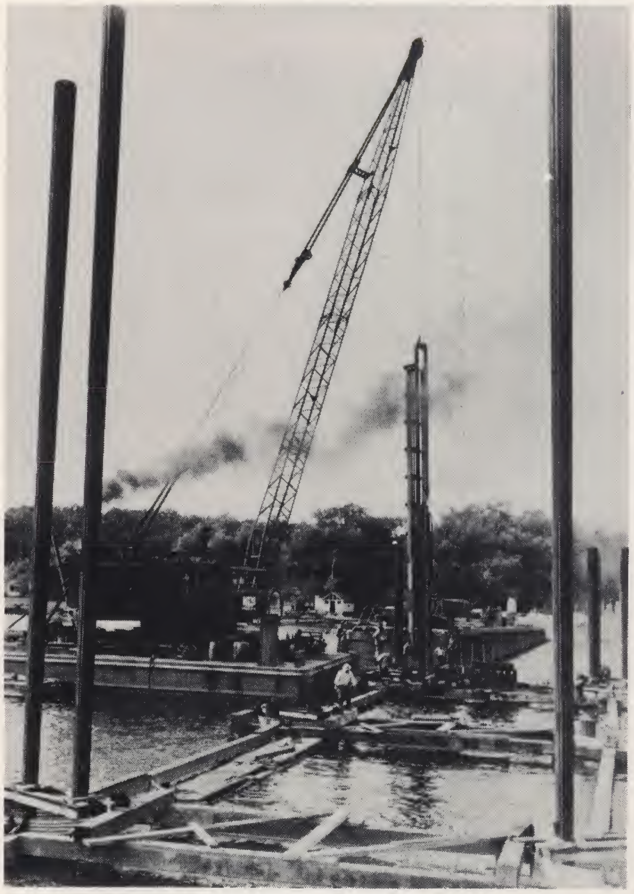
DRIVING 190-FOOT PILES FOR GIANT DAM

TUBULAR PILES IN EAST AND WEST



Batavia, N. Y. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving tapered, fluted monotube piles. Bero Engineering and Construction Co., contractors.

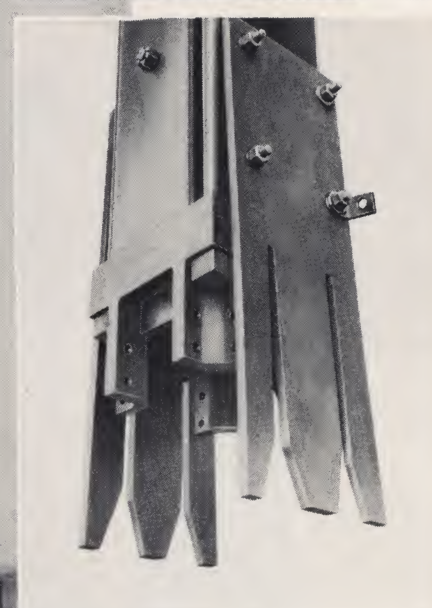
Near Barstow, Calif. McKiernan-Terry B-type Double-Acting Hammer driving monotube piles for bridge over Mojave River.



TAPERED MONOTUBE PILES FOR BRIDGE SUPPORT

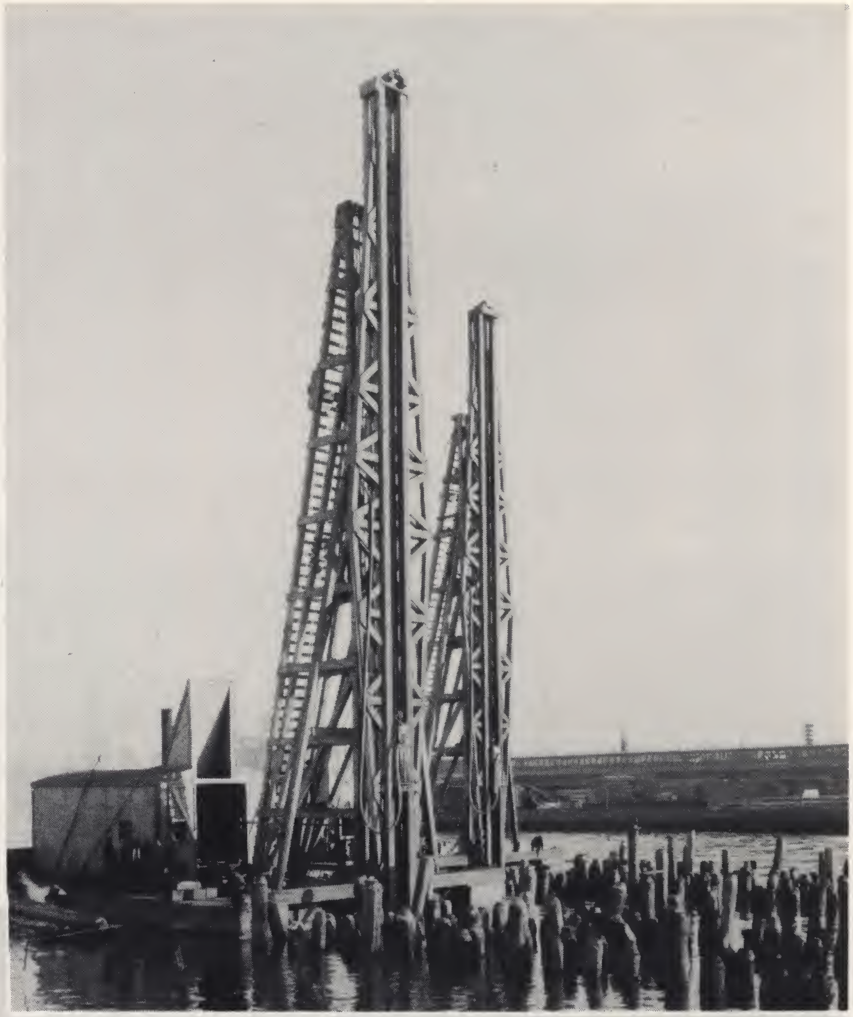
(Above two pictures) Spring Lake, Mich. McKiernan-Terry No. 10-B-3 Double-Acting Hammer driving extra-long, tapered, fluted monotube piles in constructing new highway bridge to replace old bridge indicated in background. Driven to a minimum bearing of 40 tons each, the 75-foot piles, with 20-foot extensions, in place varied from 60 to 120 feet. Contractor, Luedtke Engineering Co.

(Right) Calicoon, N. Y. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving 11-inch tapered monotube piles for Erie Railroad bridge. Parker & Graham, contractor.



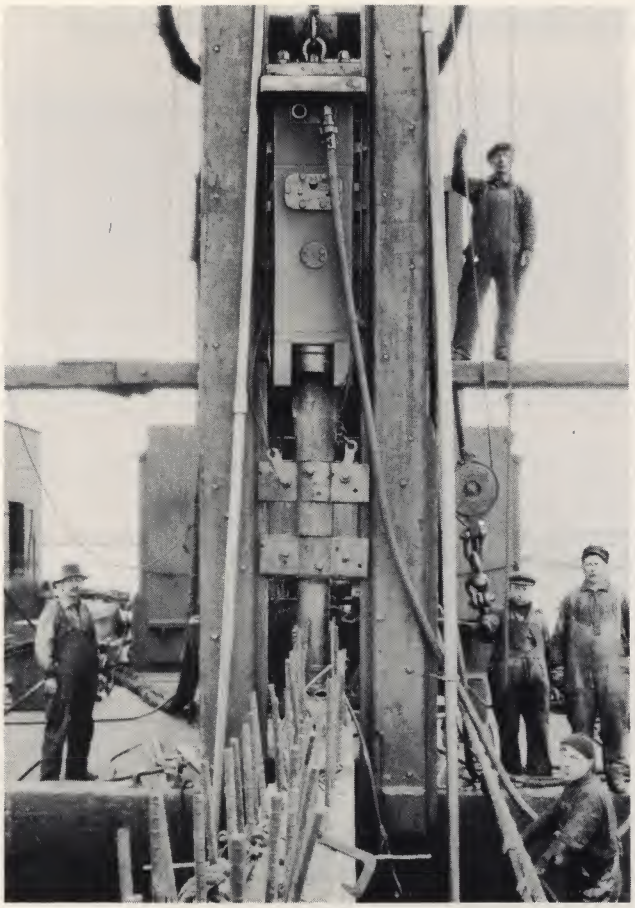
OBSTRUCTION GETS DRIVEN, TOO

Lake Ontario, Canada. McKiernan-Terry No. 9-B-3 Double-Acting Hammer used in reconstructing the Burlington Pier, about 20 miles west of Toronto. 997 interlocking sheet steel piles, 26 to 36 feet in length, were driven to completely enclose the old 850-foot wharf. A "pants" device, see photo at right, aligned the suspended hammer firmly and perpendicularly with pile, unaffected by slackness of line and block above. 2 or 3 feet of stone filling, washed from old structure, had to be penetrated, then 6 or 8 feet of sand and gravel, followed by soft clay and finally stiff clay, into which piles were driven 2 to 3 feet. At one place two piles, driven by an older hammer, were stopped 6 feet down by some obstruction, presumably a big boulder. When the McKiernan-Terry 9-B-3 was substituted, the obstruction was driven some 8 feet deeper down, where it cracked open, admitting the piles, which went down freely for at least 3 feet. Contractor, Bermingham Construction.



A FEW INCHES AWAY FROM A TUNNEL

Jersey City, N. J. McKiernan-Terry No. 9-B-2 Double-Acting Hammers used in constructing Erie Railroad pier No. 9. The job required 17-inch to 21-inch wood piles, 82 to 120 feet in length which were driven to 2 feet under water. In a single 8-hour day, one of these hammers placed 75 piles, spotting them 14 inches from the side of the Holland Tunnel. 9,200 timber piles in all were driven, a few of which are shown in lower photo. Foley Brothers, contractors.



HANDLING HEAVY CONCRETE SHEETING

(Left) Brooklyn, N. Y. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving 20-inch square tongue-and-groove concrete sheeting for the extension of Flatbush Avenue across Jamaica Bay. Driving was through hard, fine sand with overlying strata of clay to a penetration of 38 feet. A timber follower was fastened into recess in anvil and fitted with guides to ride in the pile driver leads. A renewable wood driving block, set easily between reinforcing rods, struck piles squarely in center and prevented damage to concrete. George B. Spearin, contractor.

BATTER PILES DRIVEN WITHOUT LEADS

(Two illustrations below) Staten Island, N. Y. McKiernan-Terry B-type Double-Acting Hammers driving batter piles for one of twelve 1000-foot piers. The rigging used abolished need of a pile-driver frame, enabling driving in places inaccessible to floating or ordinary land rig. A 4-foot pipe sleeve, bolted to jaws of hammer, held pile in place for driving. See close-up at left. A 3-point suspension kept the hammer fixed at any desired angle. This unique rigging, according to the city inspector in charge, permitted the driving of 2 piles to every 1 driven with drop hammers in batter leads. A total of 92 long batter piles were driven in a single 8-hour day—a pile every 5 minutes. Contractors, Terry & Tench.

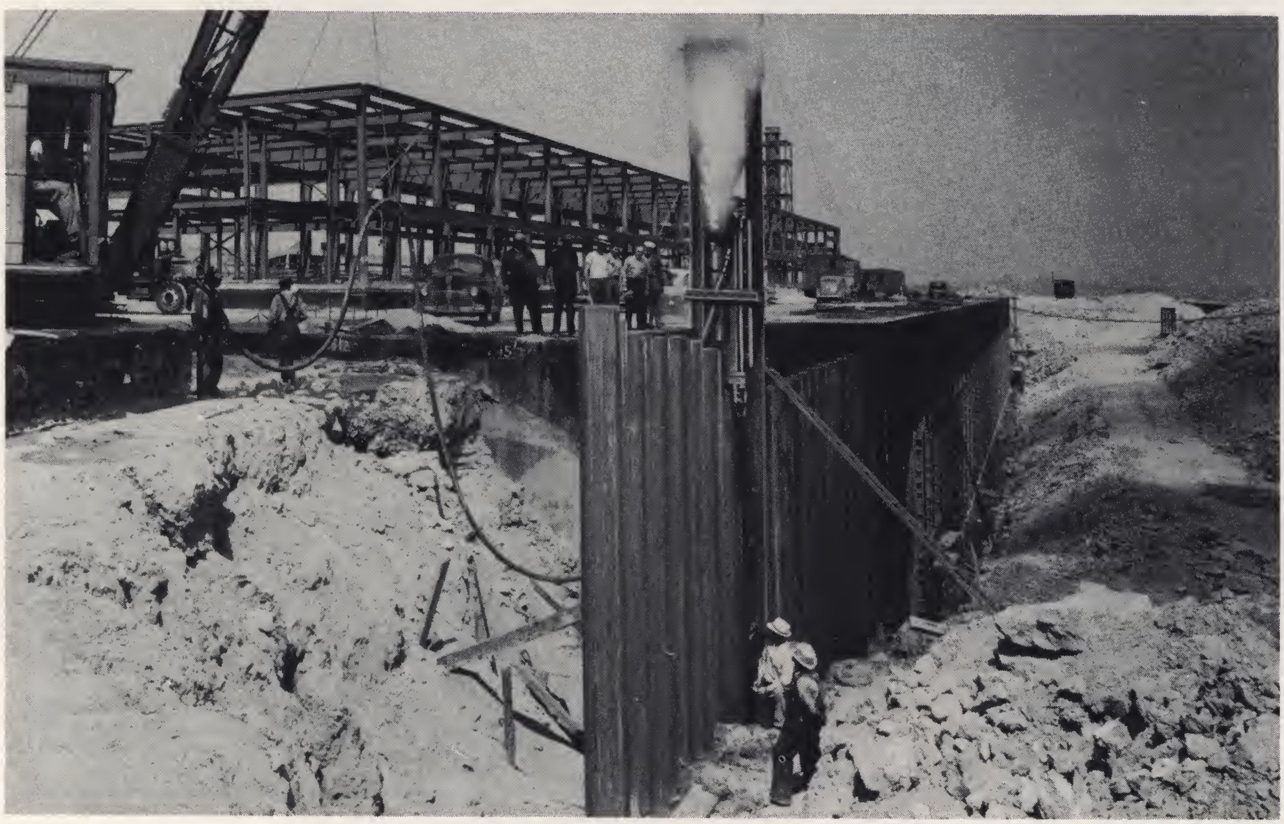
LAKEFRONT BULKHEADS - RIVERFRONT FLOOD WALLS

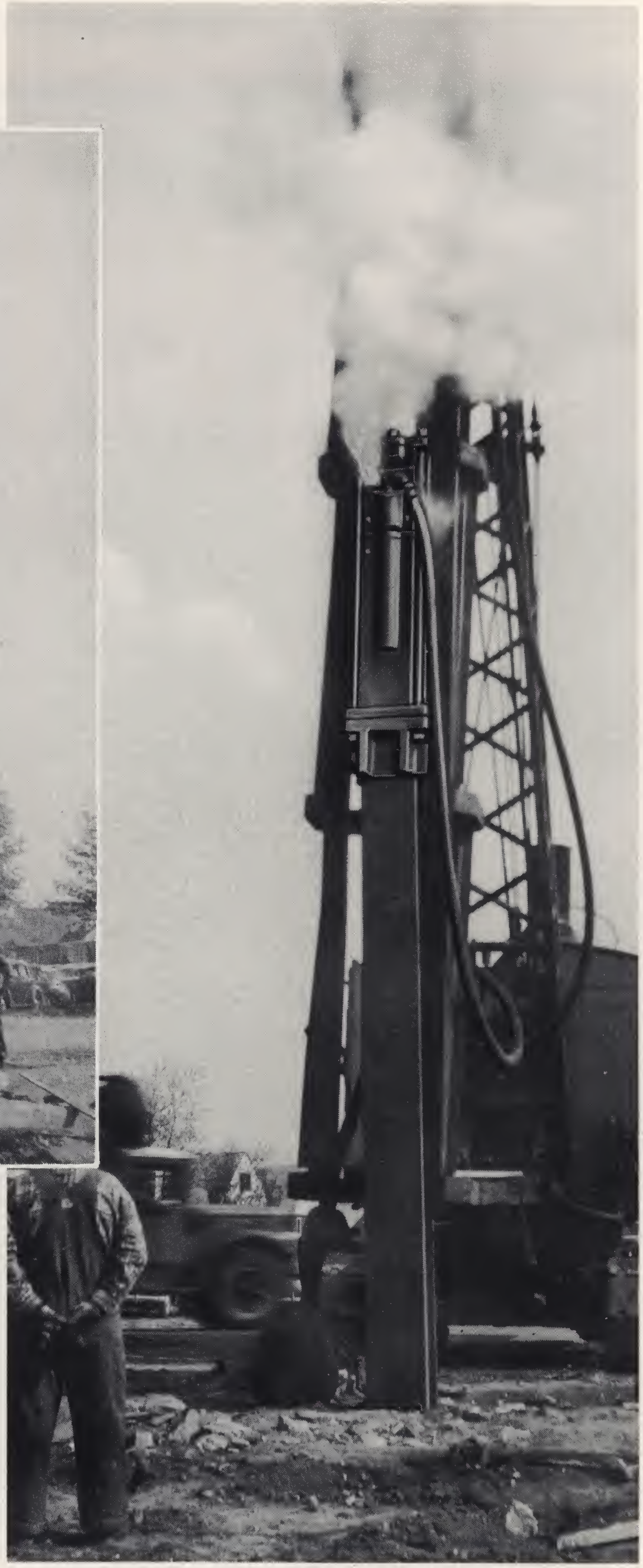
(Above) Chicago, Ill. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving batter piles for bulkheads for causeway to Northerly Island in Chicago Park District. Contractors, N. S. Mackie Co.

(Right) Cairo, Ill. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving steel sheeting for a 1½-mile cellular-type flood wall, to be flanked with levees. Part of the 20-mile chain of walls and levees protecting Cairo against Mississippi River floods. Project of U. S. A. Corps of Engineers. Ottinger Bros. Construction Co., contractors.

FILTRATION PLANT PROJECT

Chicago, Ill. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving steel sheet piling for the South District Filtration Plant. Top picture, bulkheads being driven. Lower picture, piling for south wing wall. FitzSimons & Connell Dredge & Dock Co., contractors.





H-BEAMS REINFORCE SEVERED ROADWAY

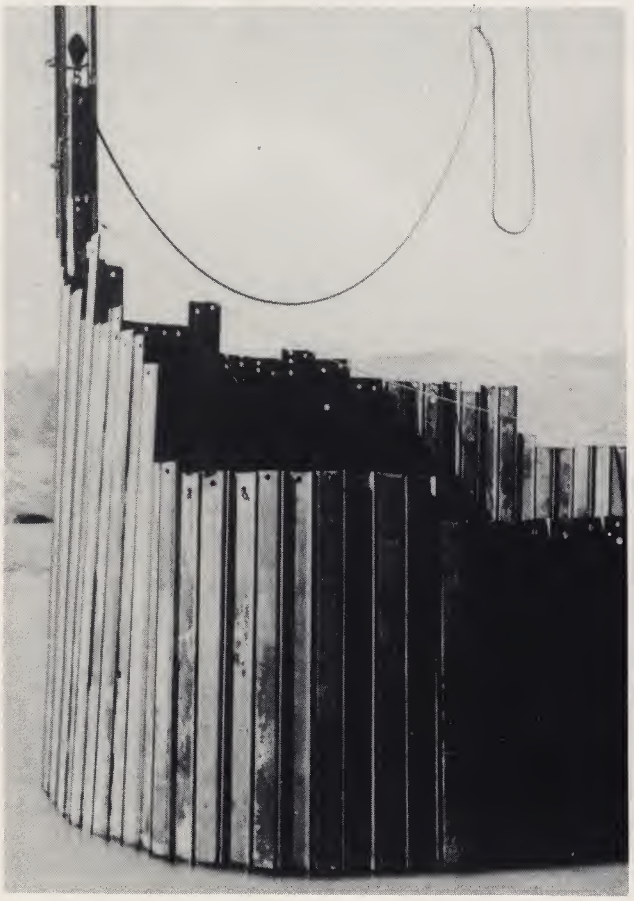
Queensboro, New York City. McKiernan-Terry No. 9-B-3 Double-Acting Hammer driving 40-foot, 12-inch x 14-inch steel H-beam piling through a 6-lane concrete highway in excavating for the Queens Corridor Sewer project. H-beams were necessary to reinforce a diagonal cut through the busy boulevard, where the concrete roadway had to be speedily removed to minimize interruption of traffic. Hendrickson Bros. Inc., contractors.

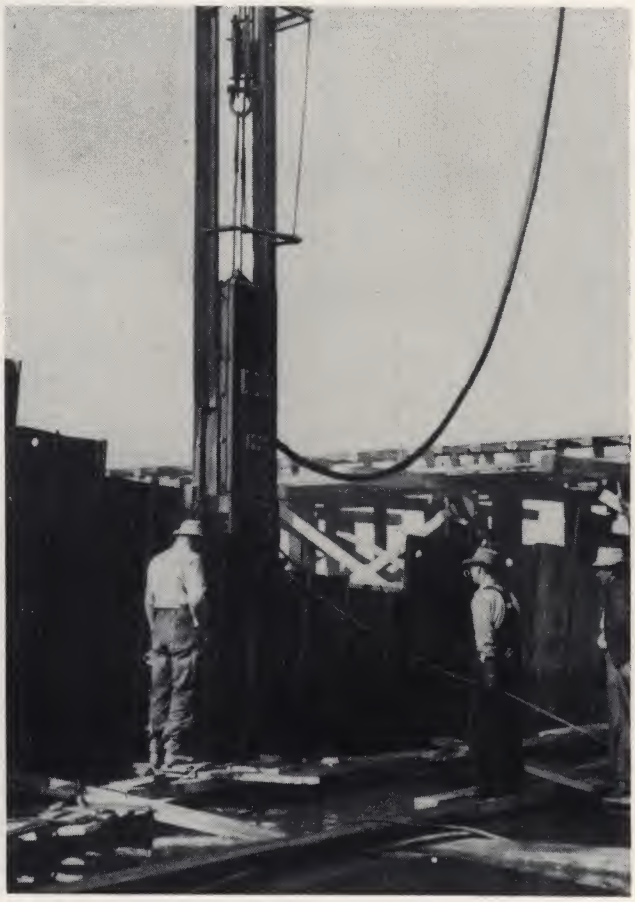
THIRTEEN PILES PER SETTING

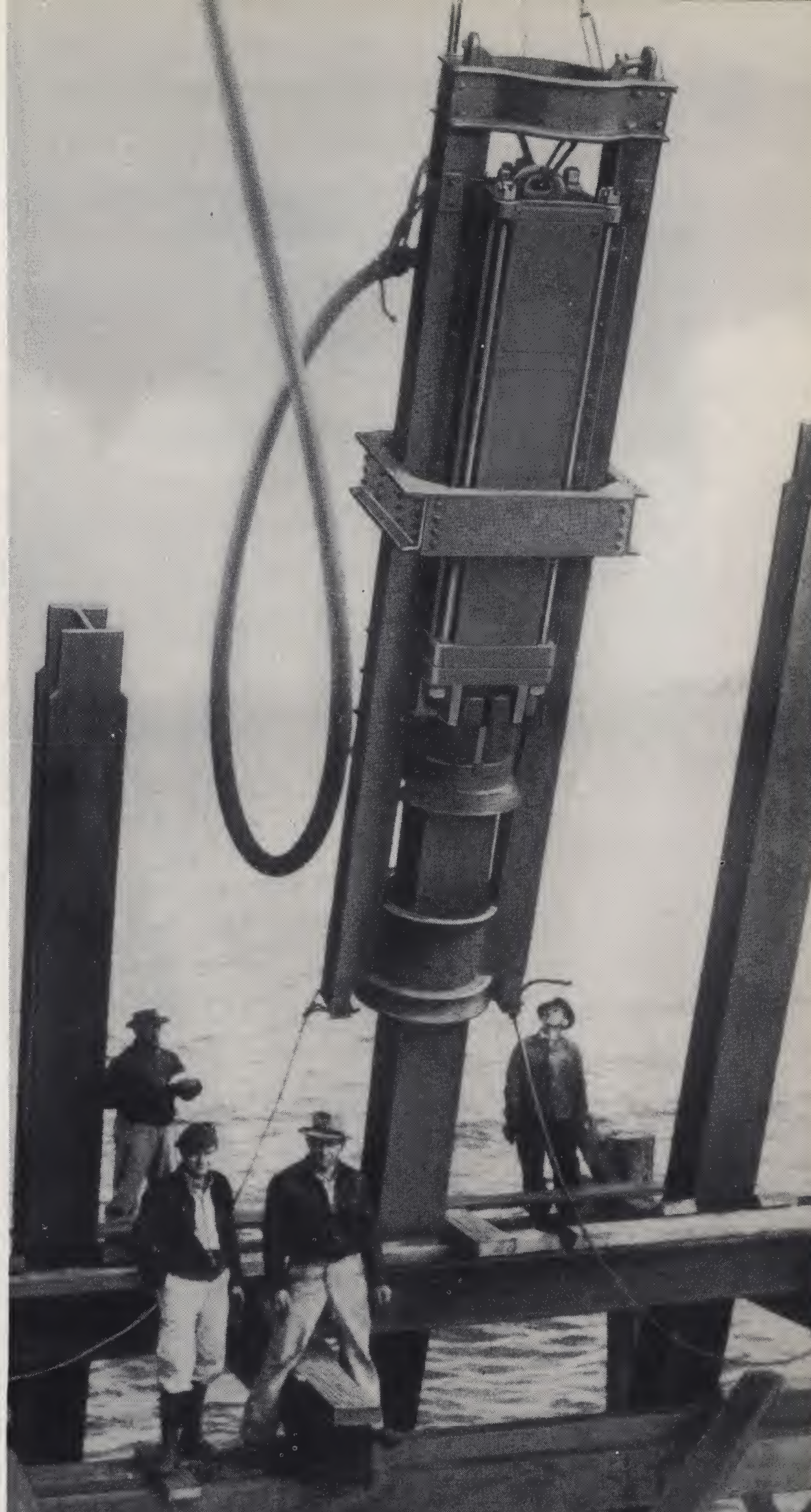
Edgewater, N. J. McKiernan-Terry No. 9-B-3 and No. 11-B-3 Double-Acting Hammers driving steel H-beam piles for the 90 x 600-foot pier of Seatrain Lines, Inc. The 9-B-3 Hammer at left is driving batter piles. The 11-B-3 Hammer at right operated in a special rig that permitted driving a bent of 13 vertical piles from a single setting. Piles were driven through silt to rock at an extreme depth of 200 feet. Contractors, J. Rich Steers, Inc.

BRIDGE-BUILDING IN ARIZONA

Topock, Ariz. McKiernan-Terry No. 10-B-2 Double-Acting Hammers driving semi-circular double-wall cofferdams into cemented volcanic gravel and boulders, in the construction of the Santa Fe Railroad bridge shown in foreground of upper picture. Kansas City Bridge Co., contractor.



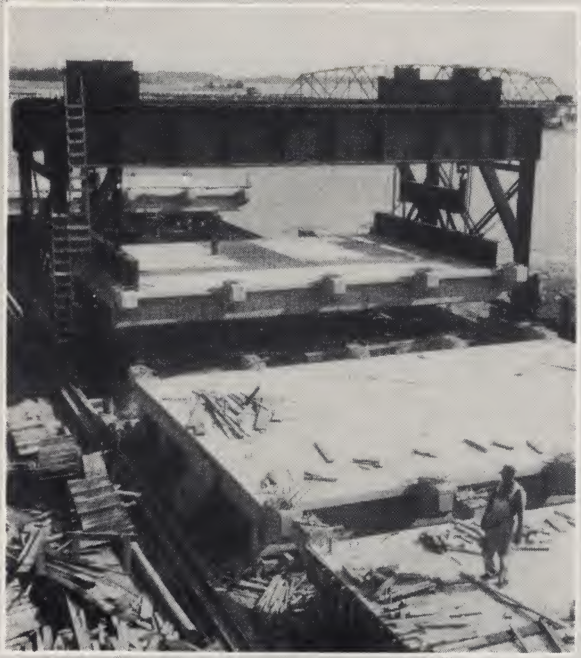




TWO WAYS TO DRIVE BATTERS

Chicago, Ill. McKiernan-Terry No. 10-B-3 Double-Acting Hammer driving steel batter piles from fixed steel leads on a lakefront improvement project. The two photos above show Z-piling bulkhead walls being driven; lower photo, H-beam batter-protecting piles. Great Lakes Dredge & Dock Co., contractors.

San Vicente, Chile. McKiernan-Terry No. 10-B-3 Double-Acting Hammer driving heavy H-beam batter piles from short hanging leads with "pants", in the construction of a new pier for Corporacion de Fomento de la Produccion. Contractor, Frederick Snare Corporation.



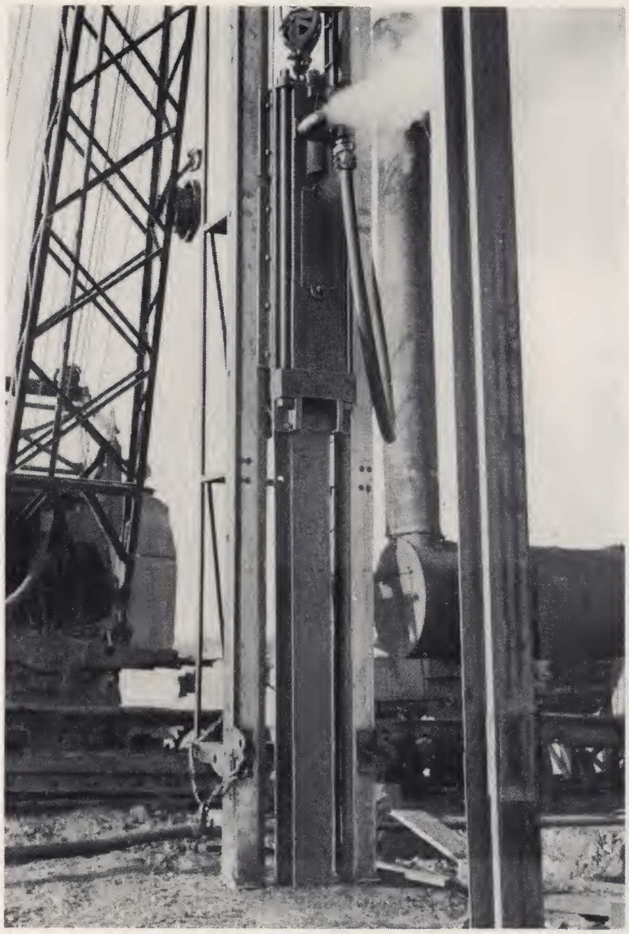
BRIDGE BUILT THE FAST WAY

West Point, Va. McKiernan-Terry No. 10-B-3 Double-Acting Hammer in a steel 5-pile guide, driving pre-cast concrete piles in bents of five at one setting for bridge across the Mattaponi River on Virginia State Highway 33. The deck of reinforced concrete was pre-cast in 40-foot lengths and laid in sections. See upper photo. Diamond Construction Co., contractors.

TO SPEED UP HOLLYWOOD TRAFFIC

Hollywood, Calif. McKiernan-Terry No. 10-B-3 Double-Acting Hammer, in swinging leads, driving steel H-beam piles for the foundation of a 4-level overpass on the Hollywood Freeway. Contractors, James I. Barnes Co.

GRADE SEPARATION PROBLEM SOLVED



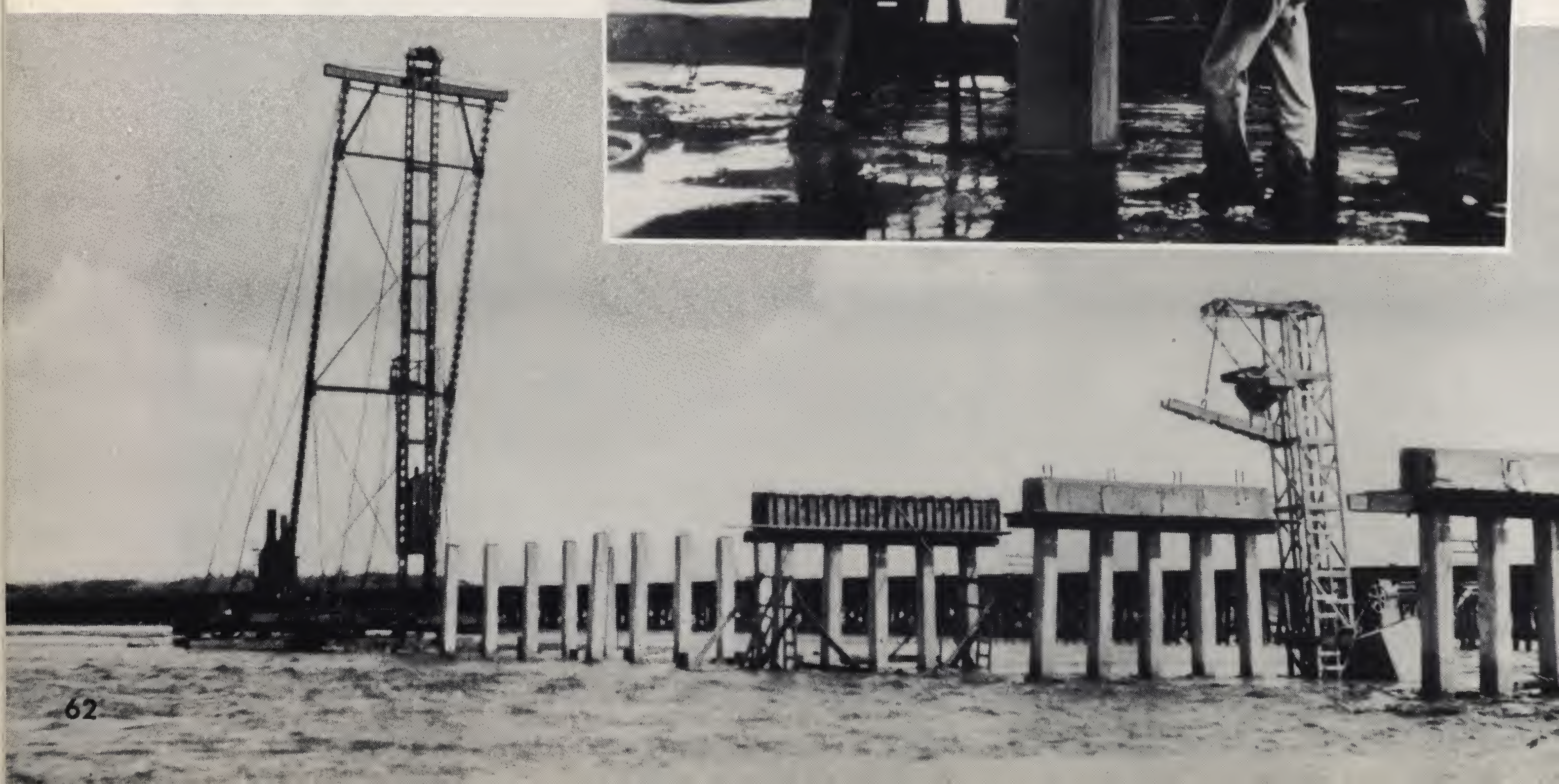
Hollywood, Calif. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving steel H-beam piles for a grade separation on Hollywood Freeway. Peter Kiewit Sons Co., contractor.

HEAVY HAMMER WITH SPECIAL "PANTS" GUIDE

Toledo, Ohio. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving MZ-38 steel sheet piling for one of the new piers of the Lakefront Dock & Railroad Terminal Co. at the mouth of the Maumee River. These piers will make coal loading facilities more accessible for lake vessels. Contractors, Walsh-Bates & Rogers Construction Co.

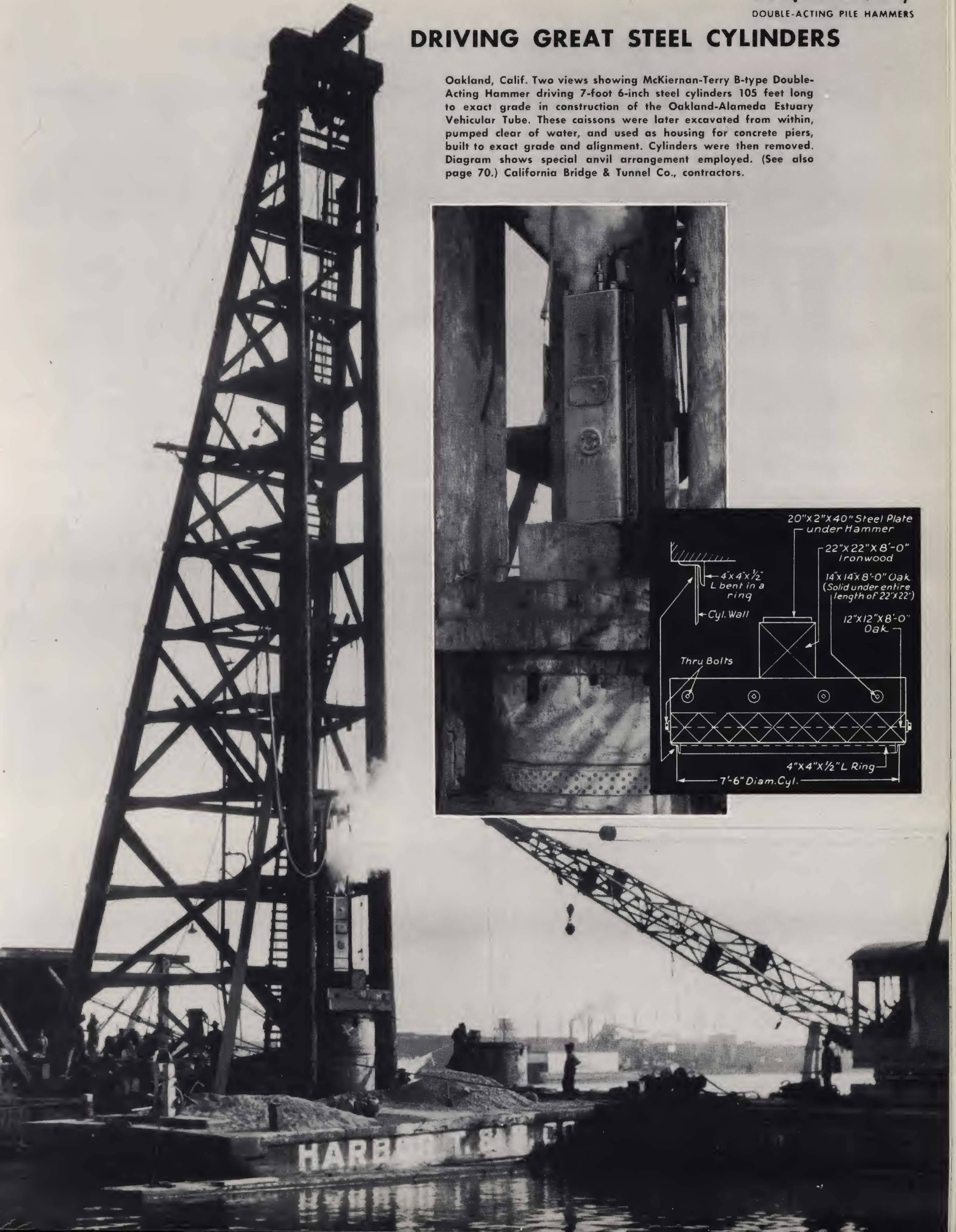
BRIDGING THE RED RIVER IN TEXAS PANHANDLE

Estelline, Tex. McKiernan-Terry B-type Double-Acting Hammer driving concrete piles for the 2553-foot bridge across the Red River on the Colorado-to-Gulf Highway. A total of 401 piles were driven to an average penetration of 23 to 35 feet, through quicksand, gravel, and frequently through several feet of shale. Ed. Abbott, contractor.

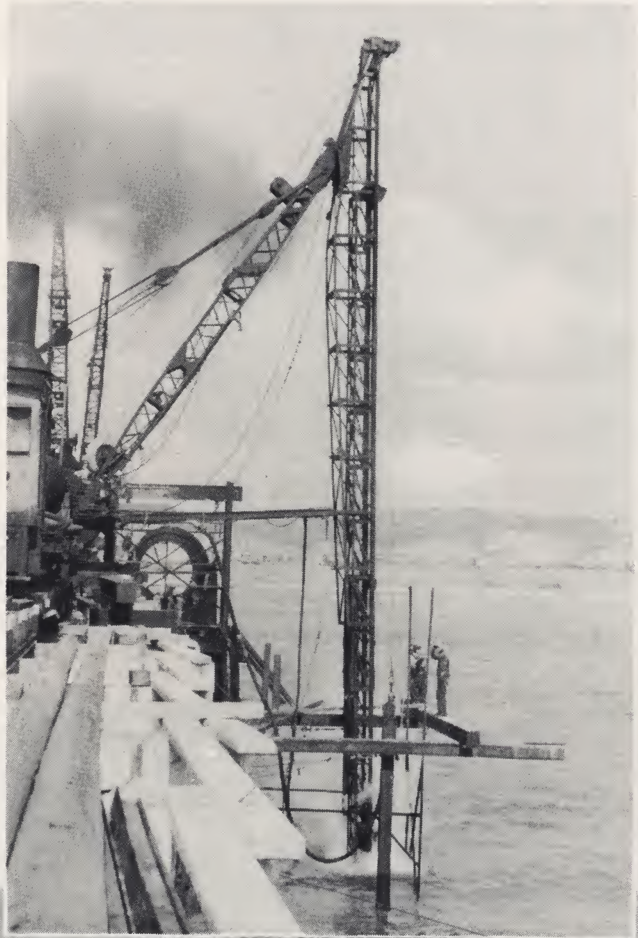


DRIVING GREAT STEEL CYLINDERS

Oakland, Calif. Two views showing McKiernan-Terry B-type Double-Acting Hammer driving 7-foot 6-inch steel cylinders 105 feet long to exact grade in construction of the Oakland-Alameda Estuary Vehicular Tube. These caissons were later excavated from within, pumped clear of water, and used as housing for concrete piers, built to exact grade and alignment. Cylinders were then removed. Diagram shows special anvil arrangement employed. (See also page 70.) California Bridge & Tunnel Co., contractors.



DRIVING FROM A LENGTHENING TRESTLE

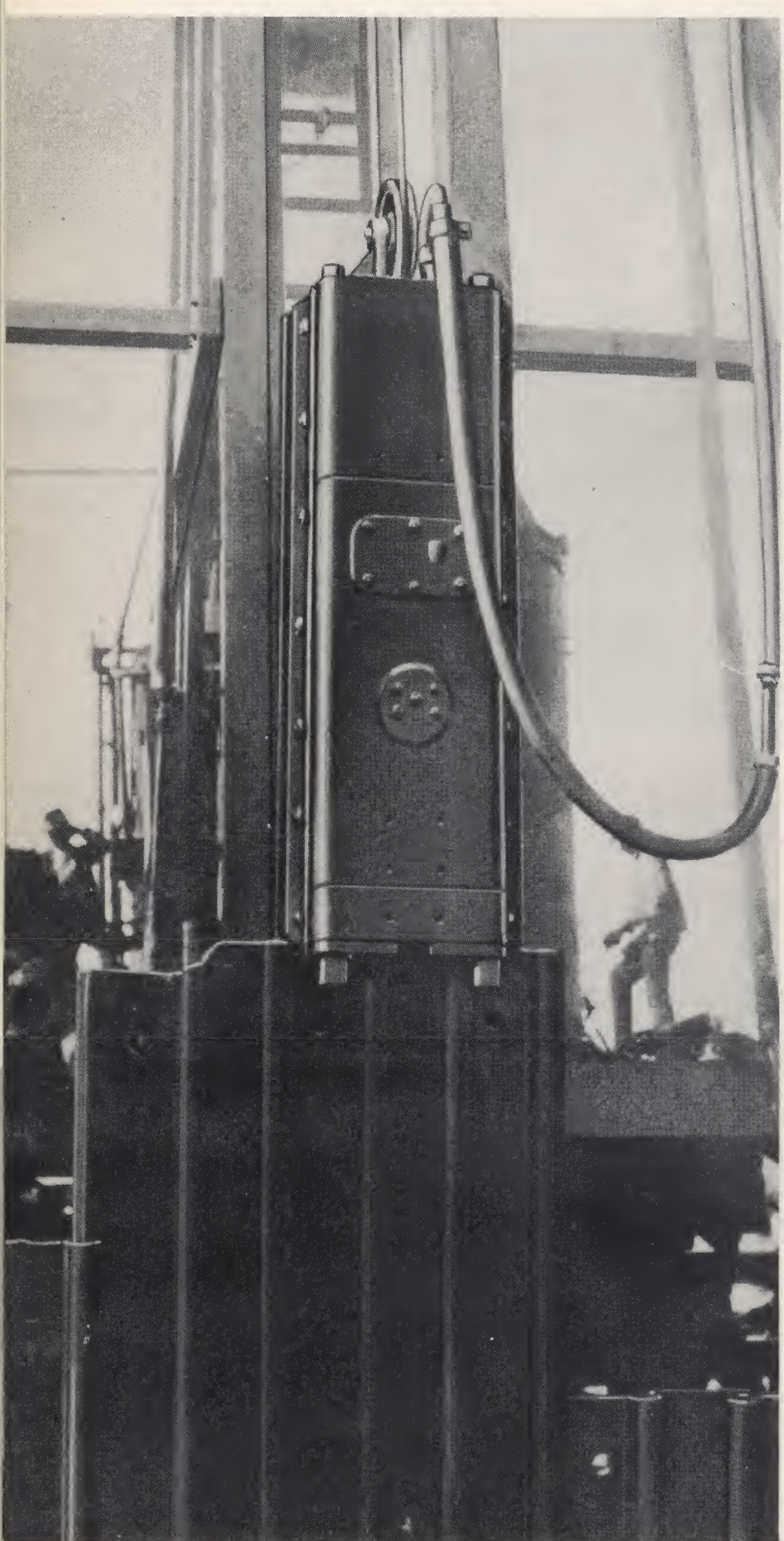


El Segundo, Calif. McKiernan-Terry No. 11-B-3 Double-Acting Hammer used in constructing the Hyperion submarine outfall sewer, stretching a mile into the Pacific, serving the City of Los Angeles. The hammer was operated from a pile driver running on rails along a timber work trestle. Only a short section of the trestle had been completed when these photos were made. Timber piles for the trestle and steel H-beams for the pipe footing and for a cofferdam to protect the 12-foot reinforced concrete sewer piping were both handled by this 11-B-3 hammer. Guy F. Atkinson Co., contractor.

CONCRETE PILES FOR BRIDGE APPROACH

Wildwood, N. J. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving 20-inch concrete piles for the approach to the Great Channel Bridge between Wildwood and Cape May. Contractors, Brann & Stuart Co.

HARD DRIVING, HEAVY PILES



Jacksonville, Fla. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving steel sheet piles for the municipal dock on the St. John's River. The job required 3600 lineal feet of 12-inch piling, with every 6 sheet piles separated by immense master pile. The 45-foot sheeting was driven to about 42 feet penetration through sand, mud, clay, phosphate, etc. The master piles, 55 feet long, were driven to about 52 feet penetration. Contractor, C. E. Hillyer.

DRIVING EXTRA-LONG STEEL PILES

San Francisco, Calif. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving vertical and batter H-beam steel piles at the Hunter's Point Naval Shipyard. The piles ranged from 140 to 165 feet in length. Ben C. Gerwick, Inc., contractors.

UNDERWATER PILE DRIVING

For many years, pile-driving under water was always difficult and expensive. Great skill and precaution were required, and the results were sometimes not entirely satisfactory because of the difficulty of determining accurately the bearing capacity of piling driven under water by means of "followers" or long piles that had to be subsequently cut off below water.

In recent years, McKiernan-Terry has revolutionized this type of work by successfully adapting McKiernan-Terry Hammers for driving under water. The following pages show underwater driving methods that have been widely adopted by contractors.

On one of the very first jobs where McKiernan-Terry underwater hammers were used, the contractor stated that the total cost of driving piles by this method was less than the former cost of sawing alone. It is not surprising, therefore, that on the strength of this advantage a great demand for McKiernan-Terry underwater hammers was established and has existed ever since. It has now been demonstrated that piles can be driven under water, even to depths of 80 feet or more, almost as easily as on land.

All B-type McKiernan-Terry Double-Acting Hammers and all McKiernan-Terry Single-Acting Hammers are as adaptable for underwater work as for driving on land or above water. The only requirement is that compressed air be supplied to the bottom cylinder of the hammer by means of an air hose connected as shown in diagrams on page 13 for the *double-acting* hammers and on page 93 for the *single-acting* hammers.

Approximately 60 cubic feet of compressed air per minute at one-half pound pressure per foot of submergence is sufficient to prevent water from entering the bottom cylinder to interfere with the reciprocating action of the ram. For greatest efficiency the exhaust is carried from the hammer to the surface through a large-diameter hose. The motive fluid operating the hammer may be either steam or compressed air.

With a movably retained, but unyielding, anvil resting on the pile, and with the driving ram of the hammer working in a cylinder from which the surrounding water is completely excluded, the full force of the blow of the ram is exerted on the pile. Consequently the driving efficiency is the same as if the work were being done above the surface, and the bearing capacity of the piles can be determined as above the surface.

McKiernan-Terry Underwater Pile Hammers eliminate the use of "followers", a feature appreciated by engineers. They also practically eliminate submarine sawing. This is because piles may be driven so close to grade in most cases that no sawing is necessary. This is especially important in cofferdams, where the bracing formerly made pile sawing very difficult and expensive.

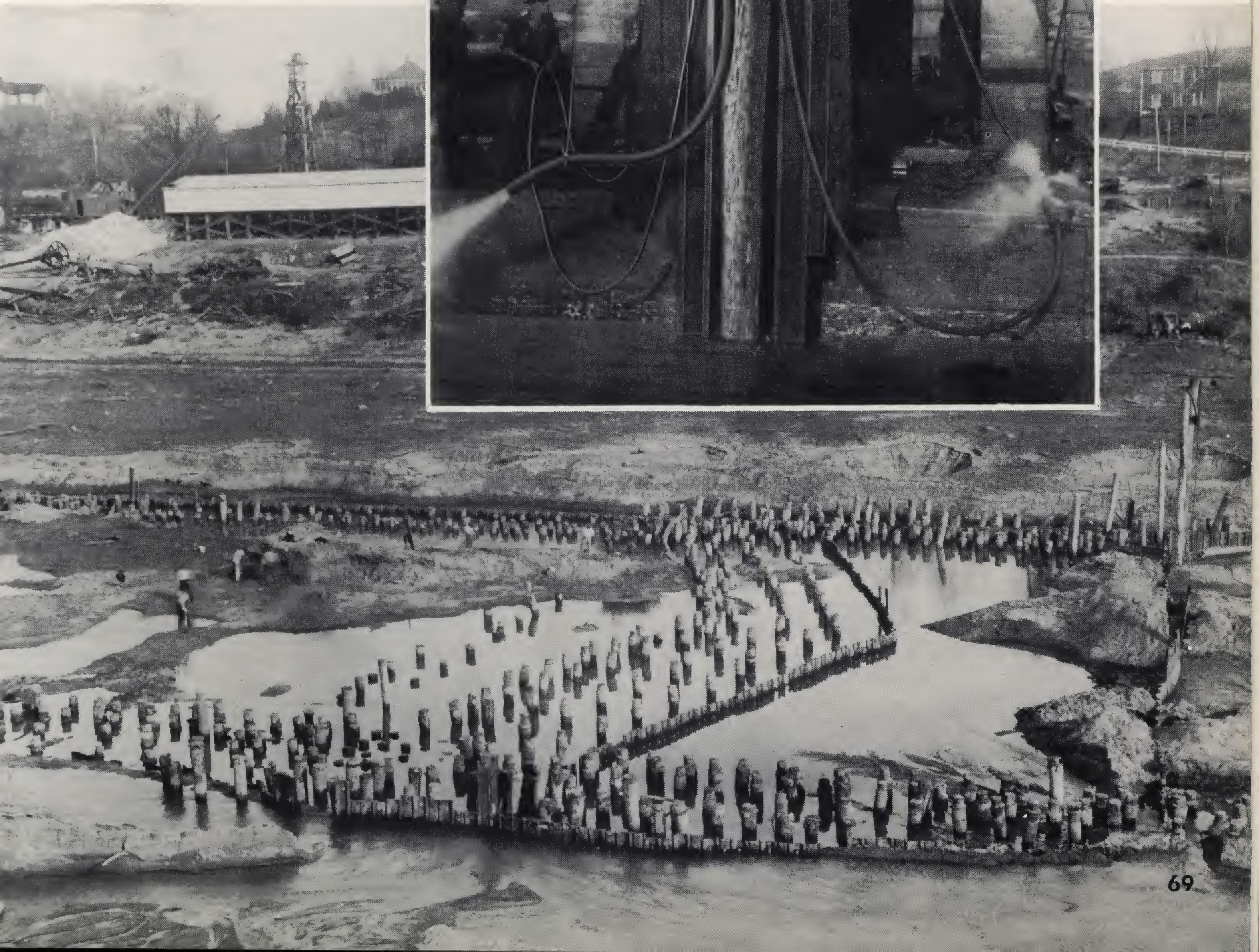
Compared with older methods of driving piles under water, the advantages of using McKiernan-Terry Underwater Pile Hammers may be summed up as follows:

- Shorter piles can be driven—with less waste of timber.
- Followers are eliminated—full force of blow delivered directly to pile.
- Bearing power is determined as on the surface.
- Piles are driven straight.
- Piles can be spaced accurately.
- No delays on account of high water.
- Divers not required, except for inspection or occasional sawing.
- When sawing becomes necessary it is made easier, as only short sections need be sawed off.
- "Blows" in cofferdams are eliminated.
- Foundation piles can be driven in large and deep cofferdams before unwatering—thus preventing disturbance of ground materials by hydrostatic pressure existing when cofferdams are unwatered before piles are driven.

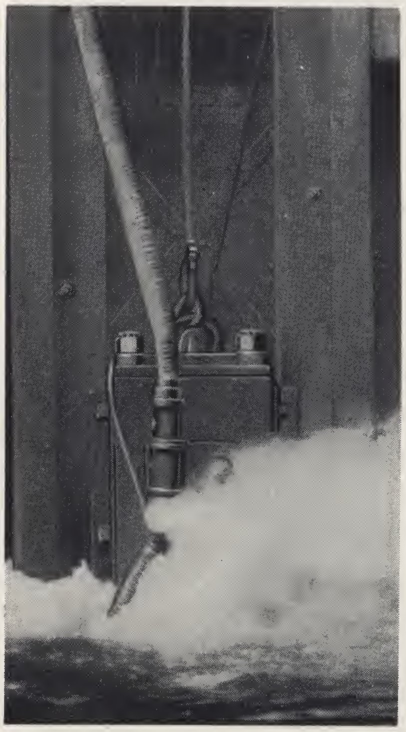
McKiernan-Terry Corporation owns the patents in the United States and foreign countries for underwater pile-driving apparatus covering double-acting, single-acting and drop hammers.

FOR AN OHIO RIVER LOCK AND DAM

Kentucky. McKiernan-Terry B-type Double-Acting Hammer used in constructing Dam No. 47 in the Ohio River. Some 3000 round foundation piles, 26 to 31 feet long, and 2000 steel sheet piles, 20 to 30 feet long, were driven. A cofferdam 2200 feet long, parallel to river bank, enclosed the entire work. Part of the driving was in hard pan, which a water jet would not penetrate, but the McKiernan-Terry Hammer drove both the round and sheet piles without difficulty. The sheet piles were driven two at a time to grade. Despite frequent necessary moving of the barge, up to 40 bearing piles 31 feet long were driven per 8-hour day, to grade 20 feet below water level.



60-FOOT PILES 40 FEET UNDER WATER



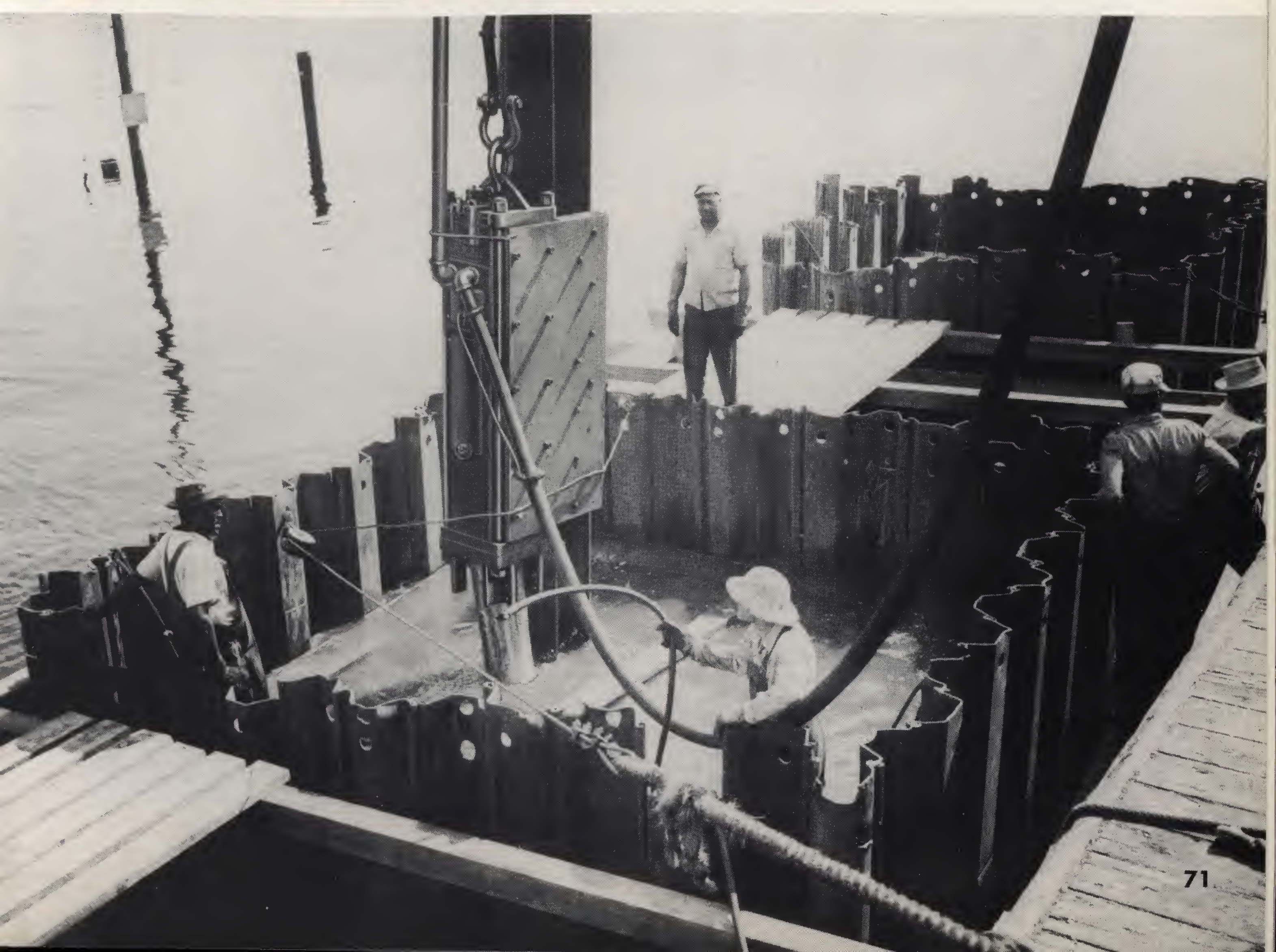
Alameda, Calif. McKiernan-Terry No. 9-B-2 Double-Acting Hammer driving 60-foot timber piles under water for the foundation of the Alameda portal building of the Estuary Vehicular Tunnel between Alameda and Oakland. The hammer first drove 525 of these piles to exact grade from 34 to 40 feet below the surface. Then, with 90-foot extension leads added, the hammer drove 1200 more piles 80 feet beneath the surface. An average of 26 piles were driven per 7 hours. Another McKiernan-Terry B-type Hammer drove heavy steel sheeting and large steel cylinders on this job. (See page 63.) California Bridge & Tunnel Co., contractors.

TO SUPPORT A LOCK THROUGH A LEVEE

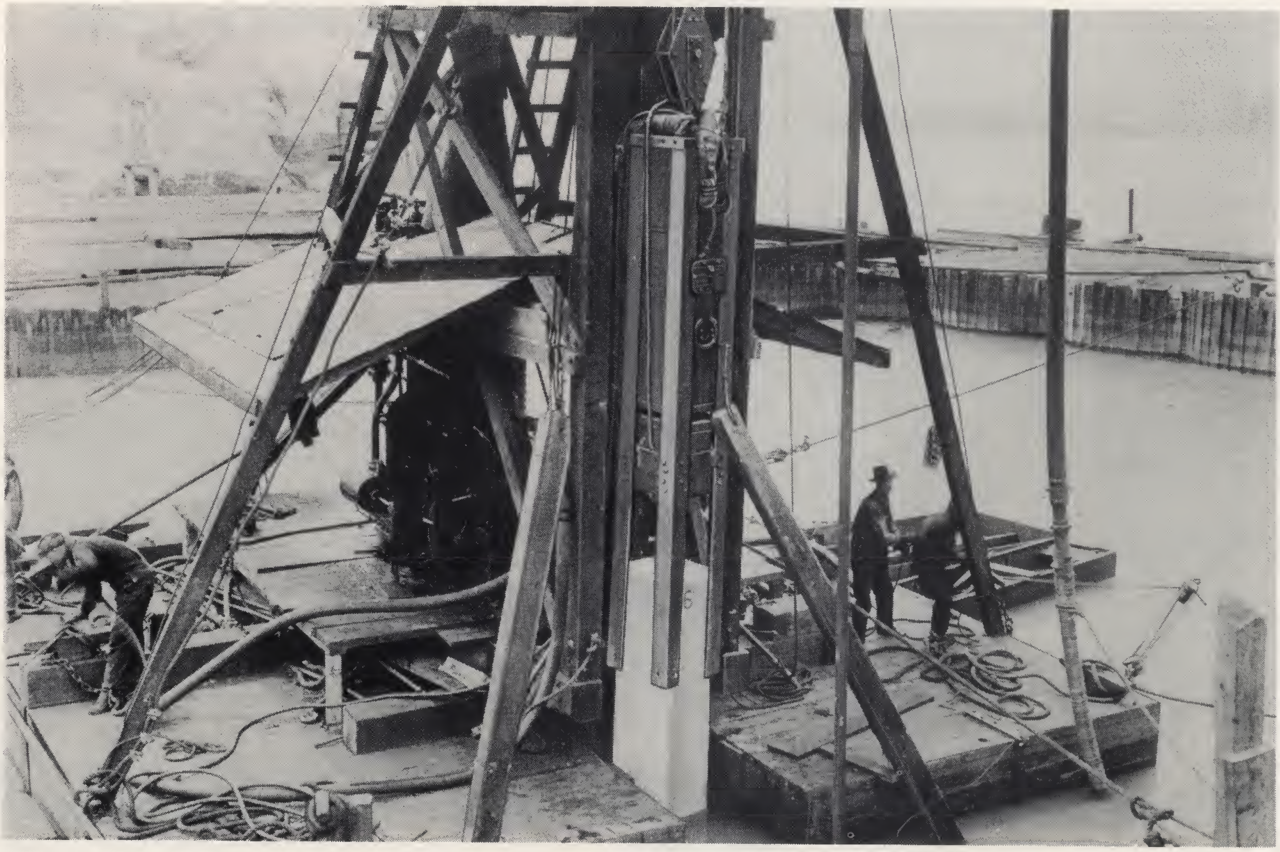
(Left) East Atchafalaya Basin, La. McKiernan-Terry No. 9-B-2 Double-Acting Hammer driving 72- to 78-foot timber piles under water to support the concrete Bayou Sorrel Lock through the basin protection levee. This lock forms a link that permits boat traffic to the Gulf Intracoastal Waterway, via Morgan City. R. Thomas McDermott & Co., Inc., contractors.

INGENIOUS METHOD OF UNDERWATER DRIVING

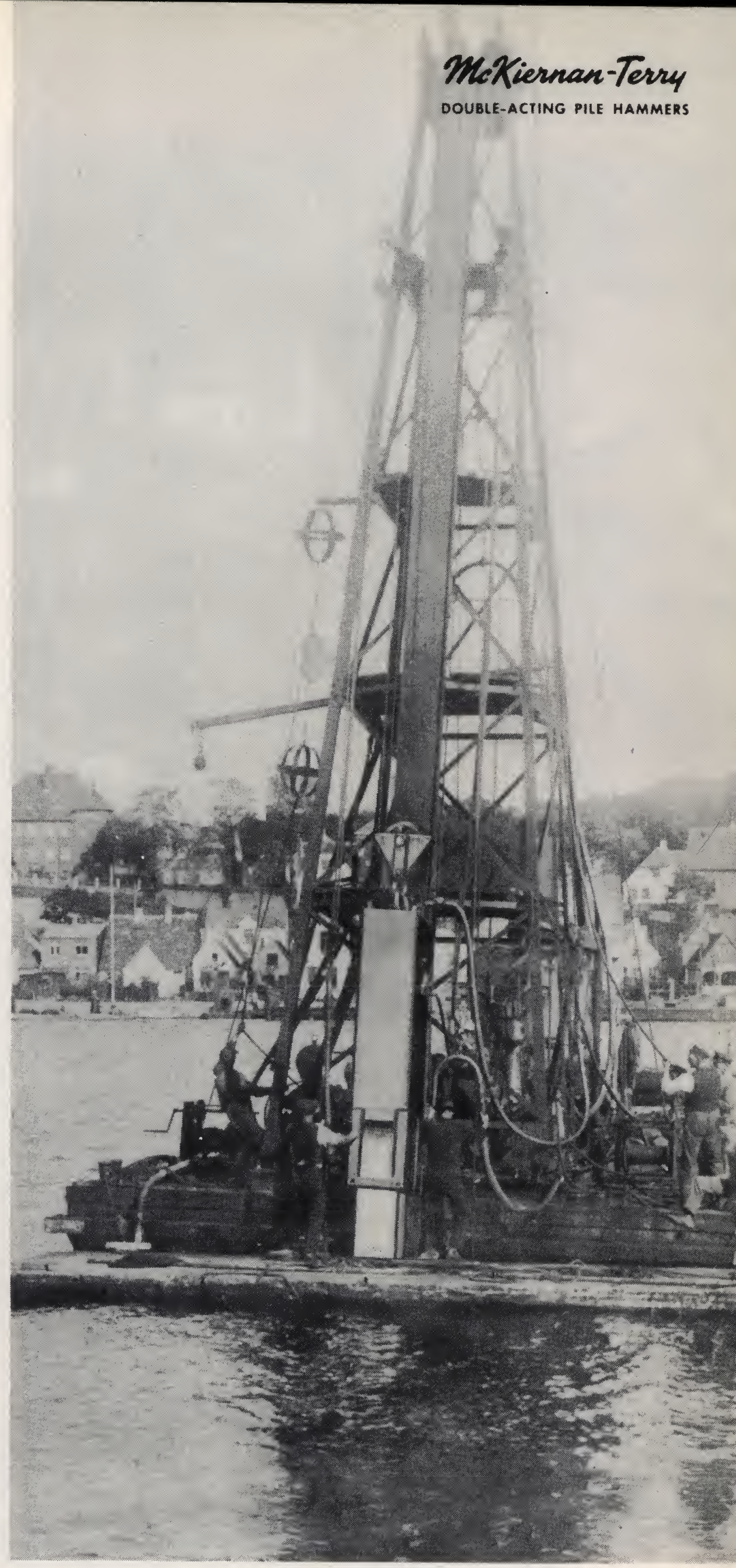
(Below) Daytona Beach, Fla. McKiernan-Terry No. 10-B-3 Double-Acting Hammer drove 1,982 timber piles, averaging 38 feet long, 12 to 20 feet under water, for the foundations of the 1,777-foot Halifax River Bridge. A heavy steel H-pile spud, pointed at the bottom, was used in place of leads. A jacket of steel plate, fitted to the hammer, rode on guides running between the H-pile flanges. The spud, when lowered, penetrated the bottom sufficiently to hold accurate position while pile was lowered and hammer placed. The 4,000 steel sheet piles forming the bridge's 78 cofferdams were driven by a McKiernan-Terry No. 9-B-3 Double-Acting Hammer. Contractors, Tidewater Construction Corp.



62,000 FEET OF CONCRETE PILING



Hine, Mo. McKiernan-Terry B-type Double-Acting Hammer driving 48- to 68-foot reinforced concrete piles under water for the foundation of the Howard Bend Water Works plant for the City of St. Louis. The tops of these piles came to rest 30 feet below the surface. Other McKiernan-Terry Double-Acting Hammers, Nos. 6 and 7 were used to drive, and later pull, the steel sheet piling used for the cofferdam. Contractors, Frazier-Davis Construction Co. See also page 31.



NO BREAKAGE, NO SAWING

Denmark. McKiernan-Terry No. 10-B-2 Double-Acting Hammer driving 12-inch square concrete piles and 70-foot timber piles 27 to 46 feet below water level for piers for a Danish State Railroads bridge. These piles were driven in 50 feet of water, through gravel, sand and hard blue clay. Driving was done from a floating frame 40 feet high, with telescopic leads 78 feet long. These leads could rest on the bottom while the big piles were being driven. No breakage of concrete pile heads occurred. The use of followers was unnecessary and underwater sawing of timber piles practically eliminated, as most piles were driven close to grade. The contractor stated that the total pile-driving cost was less than previous cost of sawing alone.

PILE TOPS 40 FEET UNDER WATER

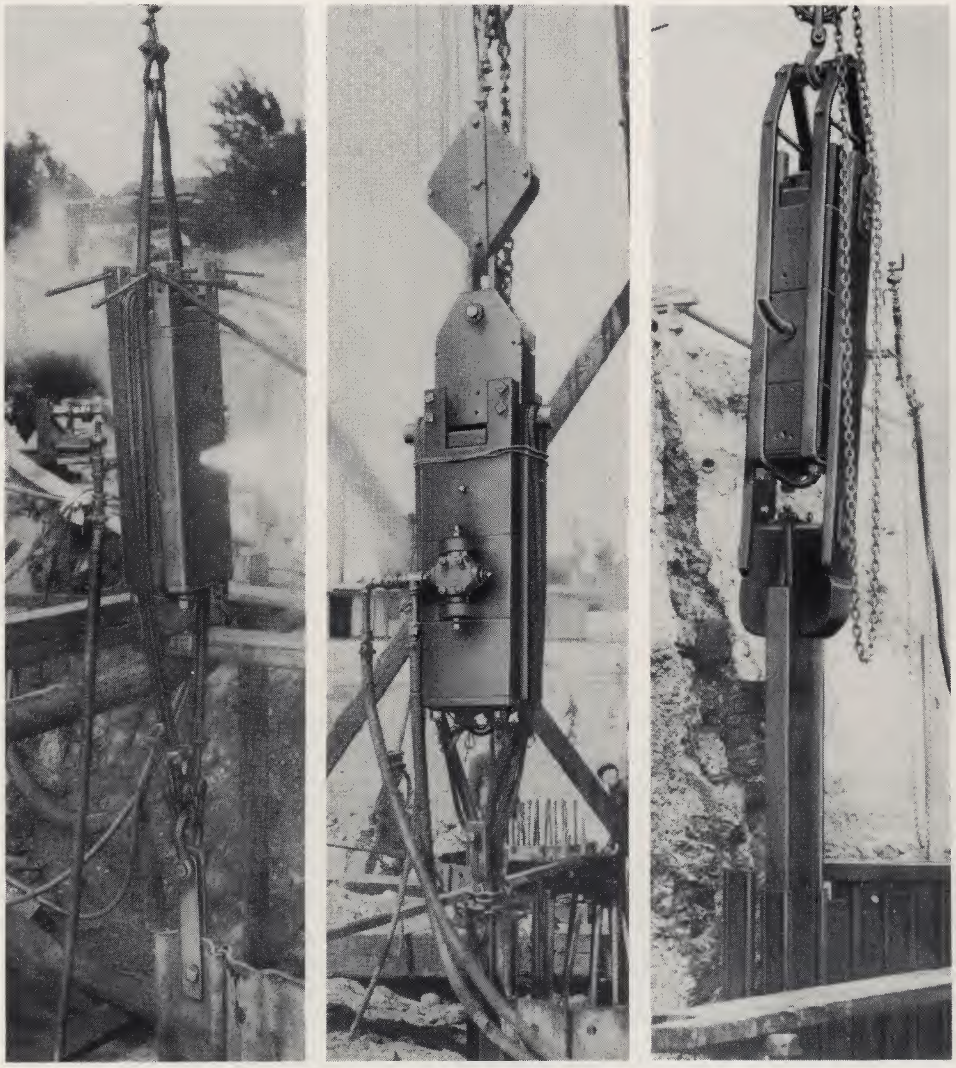
Bayonne, N. J. McKiernan-Terry No. 11-B-3 Double-Acting Hammer used in constructing the Jersey Central Railroad bridge across Newark Bay from Bayonne to Elizabethport. The job included 72 piers built in coffer-dams which rested on piles driven to within two or three feet of the compact sand and gravel bottom. Piles were 40 to 45 feet long with 12- to 14-inch butts. At low water the pile tops were about 40 feet below the surface. Two McKiernan-Terry Hammers operated in 85-foot leads supporting 70-foot telescopic leads. Piles were drawn up into a bell anvil and secured at the bottom by knives, which disengaged after the first few hammer blows. Some of these piles were driven in as little time as 3 to 5 minutes. Contractors, J. Rich Steers, Inc.

EAST AND WEST COAST UNDERWATER JOBS

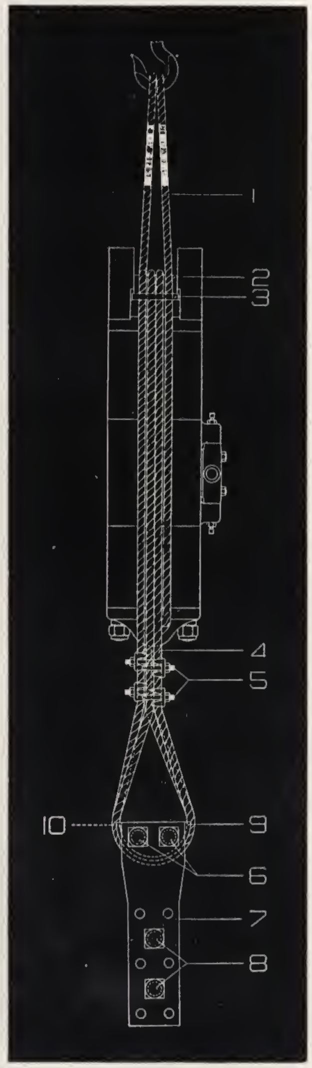
(Left) Brooklyn, N. Y. McKiernan-Terry No. 11-B-3 Double-Acting Hammer with telescopic leads driving piles under water for the extension of Wallabout Basin at the Brooklyn Navy Yard. Dry Dock Associates, contractors.

(Right) Portland, Ore. McKiernan-Terry No. 11-B-3 Double-Acting Hammer driving 40- to 50-foot piles for the Willamette River Bridge. About 800 of the 1000 piles used were driven under water. The river was 80 feet deep, with sand and coarse gravel bottom. The piles were driven 25 to 32 feet. The main leads, extending 40 feet below the surface, were 110 feet long with 70-foot telescopic leads. Piles were secured at bottom by knives, as in large photo on opposite page. Average driving time, 25 minutes per pile, including placing in leads, securing, lowering and driving. Pacific Bridge Company, contractors.

TURNED UPSIDE DOWN—THEY *PULL*



Pulling piles with inverted McKiernan-Terry Double-Acting Pile Hammers. *Left*—No. 6 Hammer pulling 14-inch arch web steel piling, using standard rig shown at right of page. *Center*—Pulling sheet piling 44 feet long, concreted to a depth of 41 feet—without difficulty. *Right*—Special pulling rig, used in England, made of steel bars with grips to pile webs.



Cable pulling rig commonly in use. Can be furnished for Nos. 5, 6 and 7 McKiernan-Terry Double-Acting Pile Hammers.

USING HAMMERS TO PULL PILES

Many years ago McKiernan-Terry pioneered the use of inverted pile hammers for pulling piles. Fitted with suitable rigging to go between crane or derrick hook and the piling to be pulled, the hammer, turned upside down, delivers powerful *upward* blows, that are effective in dislodging stubbornly set piling. This use of McKiernan-Terry Hammers has been standard practice throughout the world ever since first introduced. About twenty years ago, however, McKiernan-Terry began designing extractors, whose sole purpose was to pull piles. Now supplied in two standard sizes, McKiernan-Terry Double-Acting Pile Extractors are shown and described on the pages immediately following.

McKIERNAN-TERRY CABLE PULLING RIG PARTS
For Nos. 5, 6, and 7 Hammers

Part No.	Name	No. Req.	Code Word
1	Crane Sling	1	ADPAD
2	Grooved Saddle Block	1	ADPEB
3	Retaining Ring	1	ADPIF
4	Pile Sling	1	ADPOG
5	Clips	8	ADPUH
6	Pile Sling Bolt and Nut	2	ADRAE
7	Pile Clamp	2	ADRIG
8	Pile Bolt and Nut	2	ADROH
9	Half Sheave (single)	2	ADSAH
10	Half Sheave (double)	1	ADSEI

Note: When ordering parts be sure to specify whether for No. 5, 6, or 7 Pile Hammer
Part Nos. 5, 9 and 10 not used on No. 5 Pile Hammer.
Pulling Rig, complete, for No. 5 Pile Hammer .... ORNOB
Pulling Rig, complete, for No. 6 Pile Hammer .... OROZU
Pulling Rig, complete, for No. 7 Pile Hammer .... ORRUF

McKIERNAN-TERRY DOUBLE-ACTING PILE EXTRACTORS

"We have known for a long time that a McKiernan-Terry Hammer will drive any piles that can be driven. We have learned that a McKiernan-Terry Extractor will pull them out." This is an unsolicited statement of a well-known pile-driving contractor.

Over forty years ago, a progressive contractor discovered that a McKiernan-Terry Double-Acting Hammer could be operated in an inverted position and would then extract steel sheet piling more rapidly and with less expense for rigging than by any other means then available. This method of extracting piles is still in common use, but as much more piling is being extracted today than ever before, a distinct need has developed for a self-contained extractor which could be put immediately into use without special rigging.

To meet this need, McKiernan-Terry Corporation designed its double-acting pile extractors years ago. These extractors follow the same mechanical principles that are used in McKiernan-Terry Pile-Driving Hammers, and after thorough tests on various kinds of pulling work they were offered to the trade and quickly won the enthusiastic approval of users.

Both the E-2 and E-4 McKiernan-Terry Pile Extractors are built ruggedly to stand up under the severe service imposed by this kind of work. In addition to exceptional power and sturdiness, their design includes the means necessary for quickly connecting up to the pile, placing it where desired after extraction, and disconnecting the pile without loss of time.

The high frequency and energy of the sharp uncushioned blows of a McKiernan-Terry Pile Extractor vibrates and loosens the most stubbornly set piling.

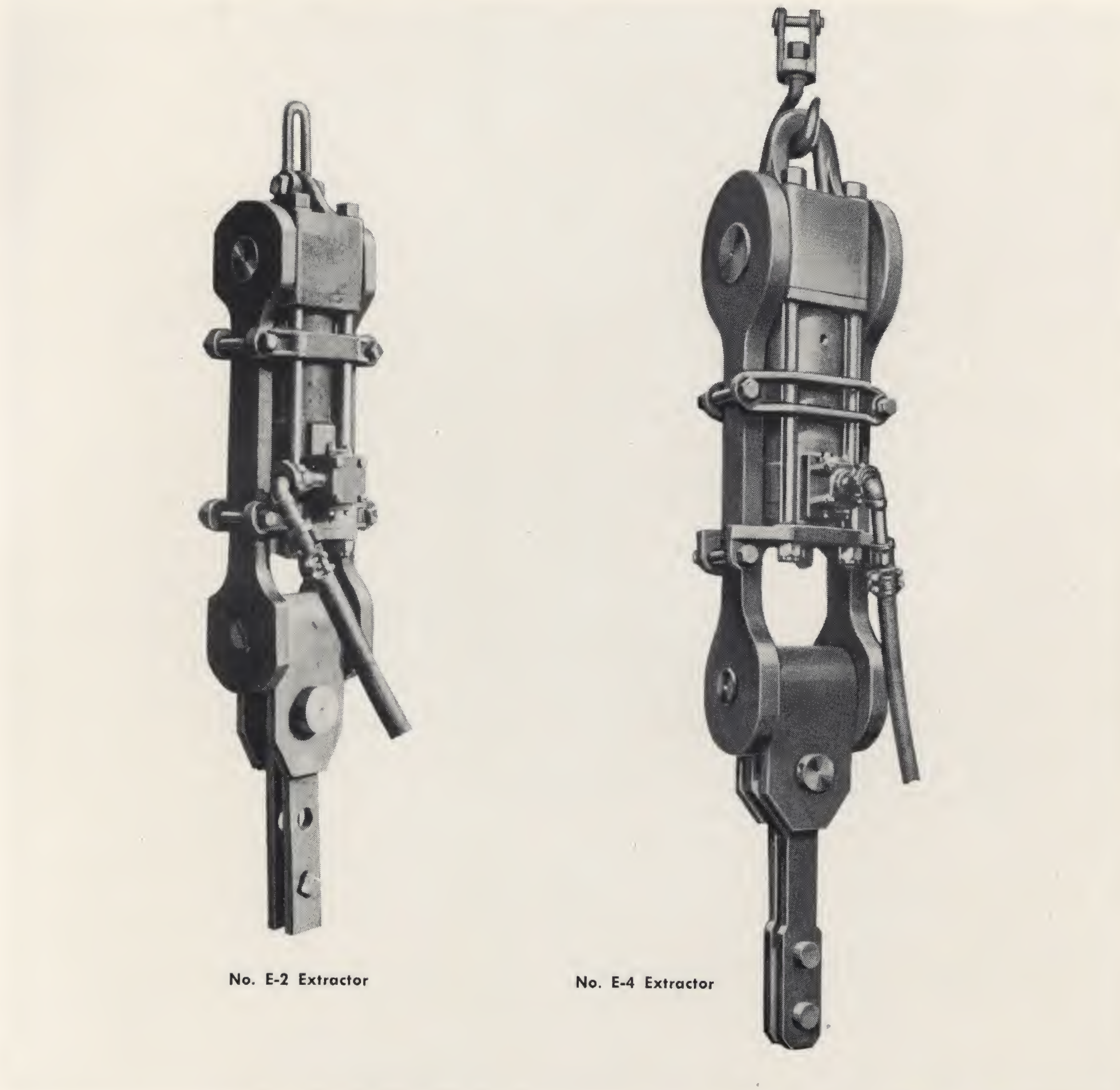
Economical extraction of piling is dependent upon the combination of vibration, caused by a heavy upward blow, and a continuous pull on the member to be removed. For the average light extracting job the E-2 Extractor is recommended; but for longer, heavier and more stubbornly set piling, the E-4 Extractor should be used. The E-2 Extractor is designed to withstand a crane pull up to 50 tons and the E-4 Extractor up to 100 tons.

As an illustration of McKiernan-Terry Extractor efficiency, reports have been submitted by users to the effect that these Extractors have successfully pulled piling that could not be removed with other and much larger types of pile extractors.

Tables listing the principal characteristics of both Extractors will be found on Page 79.

BENT, CRIMPED PILES PULLED WITH EASE

Chicago, Ill. McKiernan-Terry No. E-4 Pile Extractor pulling steel sheet piling used in construction of the west abutment of the Harlem Avenue Viaduct. This piling had been driven through 40 feet of hard clay and 5 feet of boulder-filled wet sand down to solid rock. In many instances the bottom ends of the piles were found split, bent and crimped. "The majority of these piles," to quote the contractor, "simply walked out of the holes. Even bent and crimped pieces came out with surprising ease." Contractor, E. J. Albrecht Co.



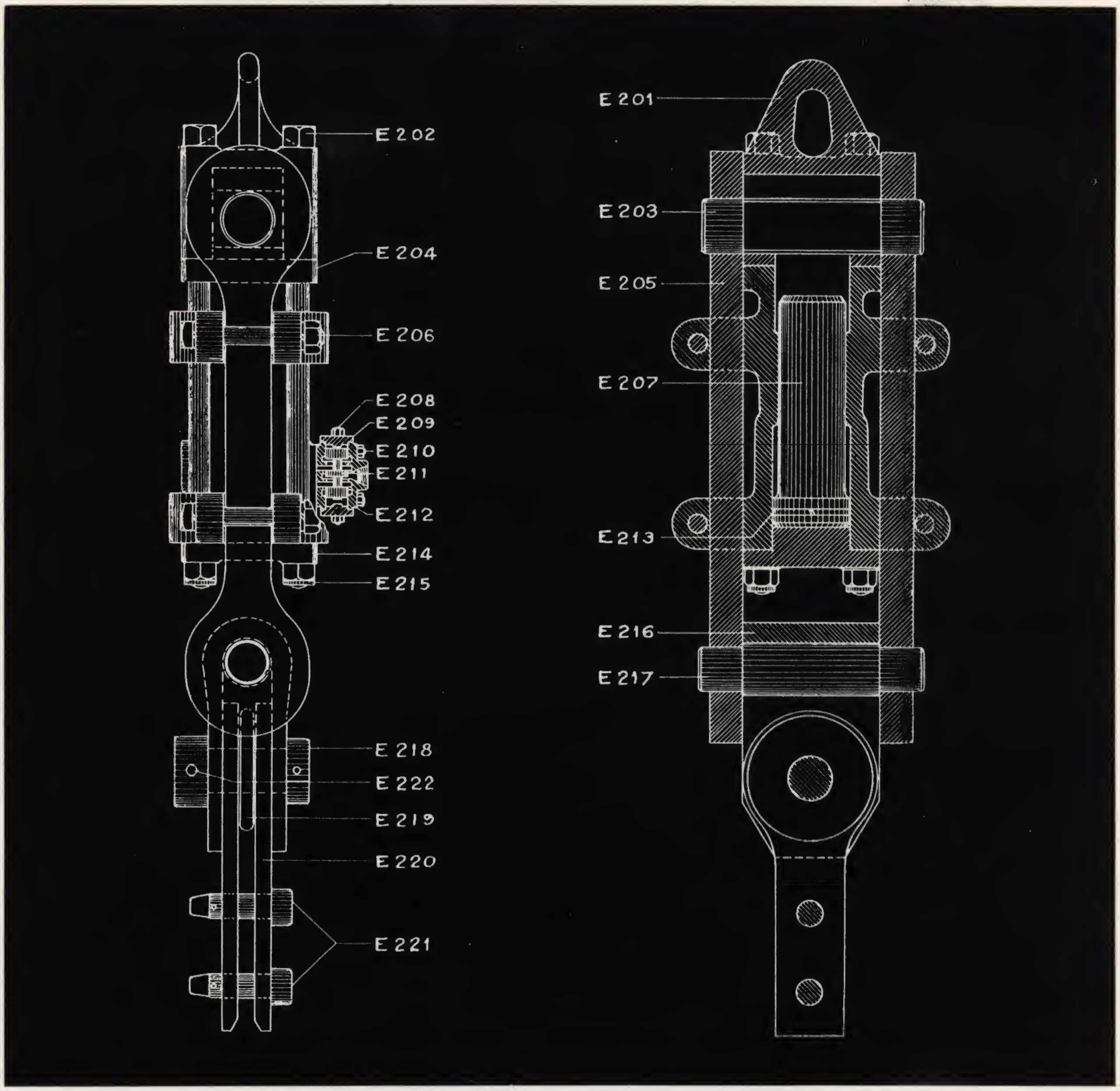
No. E-2 Extractor

No. E-4 Extractor

SPECIFICATIONS OF McKIERNAN-TERRY DOUBLE-ACTING PILE EXTRACTORS

EXTRACTOR SIZE	E-2	E-4
Net weight of extractor and attachment, pounds	2600	4400
Weight of ram, pounds	200	400
Bore, inches	7	9
Stroke, inches	3	3
Energy per blow, foot pounds	700	1000
Blows per minute	450	400
Width overall, inches	25	26
Depth overall, inches	19	22
Length overall, inches	100	125
Diameter of pile clamp bolt, inches	2⅜	2⅜
Width of standard pile clamp, inches	6	6
Air consumption, cubic feet per minute, actual	400	550
Boiler horsepower	30	35
Hose connection, inches	1½	1½
Maximum crane pull, tons	50	100
Code word for Extractor	PULAT	RABAL

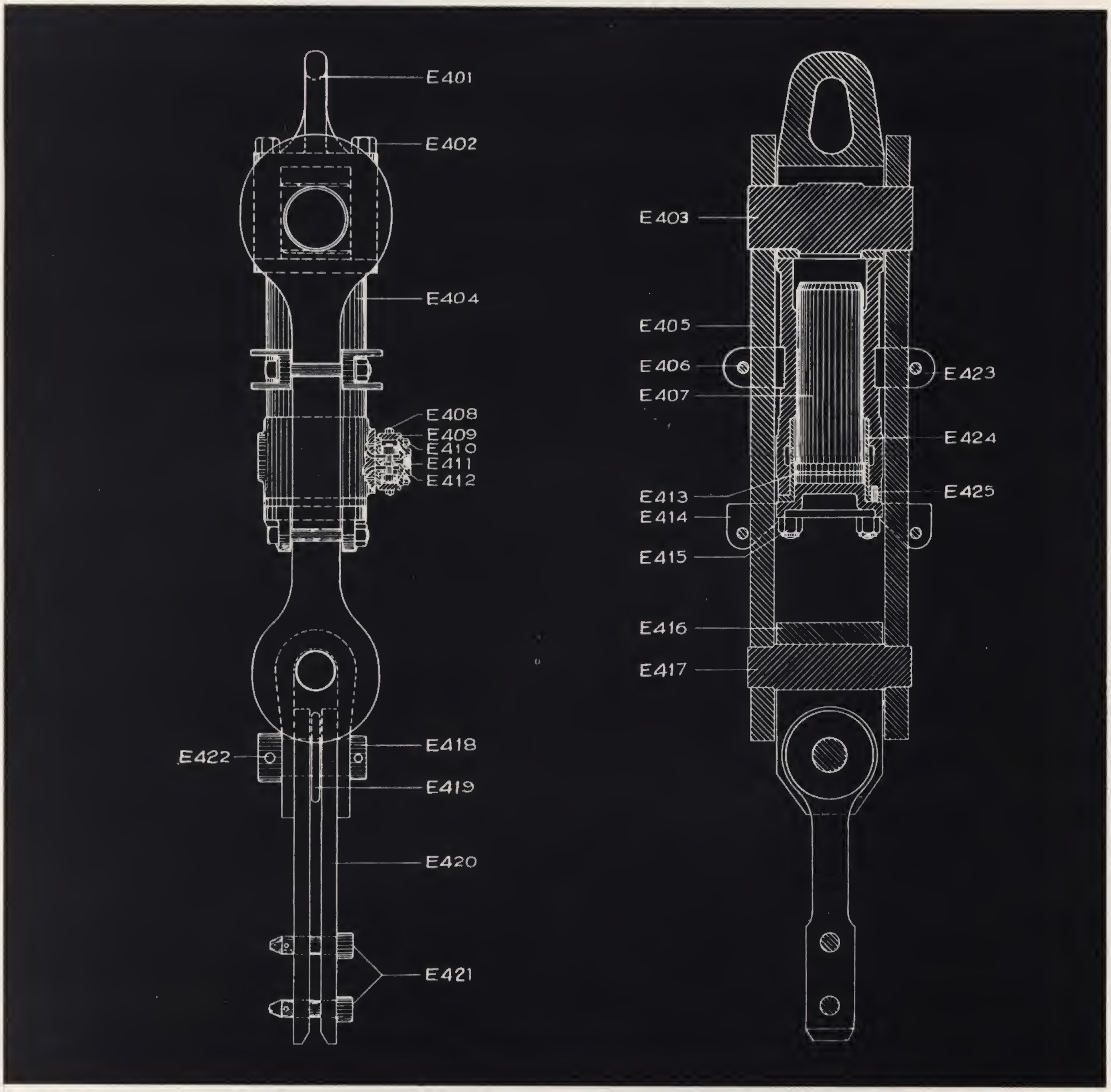
Steam or air pressure should not exceed 125 lbs. gauge pressure



PARTS LIST FOR NO. E-2 PILE EXTRACTOR

No. E-2 Pile Extractor Code Word—PULAT

Part No.	Name	No. Req.	Code Word	Part No.	Name	No. Req.	Code Word
E-201	Top Head	1	PULOX	E-212	Valve Chest	1	PUPEZ
E-202	Tie Rod	4	PULSA	E-213	Piston Ring	1	PUPIB
E-203	Anvil	1	PULTE	E-214	Bottom Head	1	PUPOC
E-204	Cylinder	1	PULUZ	E-215	Tie Rod Nut	4	PUPUD
E-205	Side Strap	2	PULVI	E-216	Yoke	1	PUPWA
E-206	Side Strap Guide Bolt and Nut	4	PULWO	E-217	Yoke Pin	1	PUPXE
E-207	Ram	1	PULZY	E-218	Pile Clamp Pin	1	PUPZI
E-208	Chest Cover Stud and Nut	4	PUPAX	E-219	Spacer	1	PURAZ
E-209	Chest Cover	2	PUPBO	E-220	Pile Clamp	2	PURBI
E-210	Chest Stud and Nut	4	PUPCU	E-221	Pile Clamp Bolt	2	PURCO
E-211	Valve	1	PUPDY	E-222	Taper Pin	1	PURDU

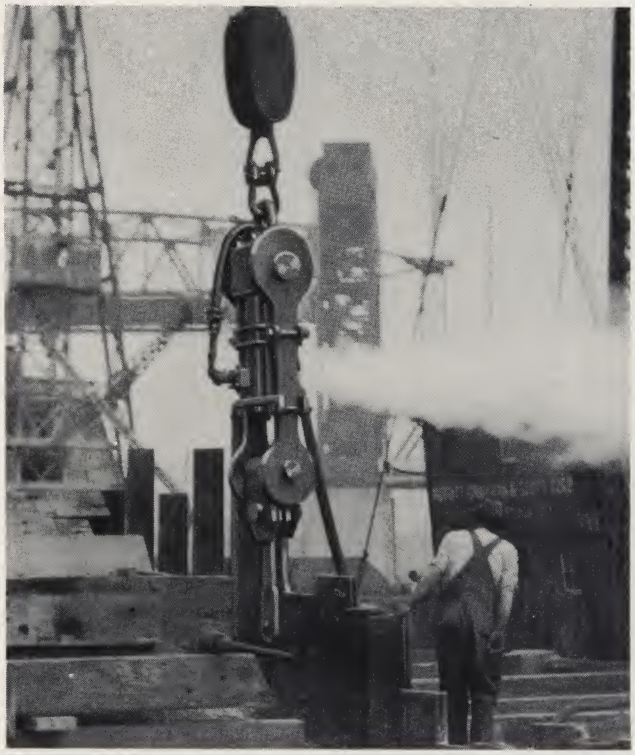


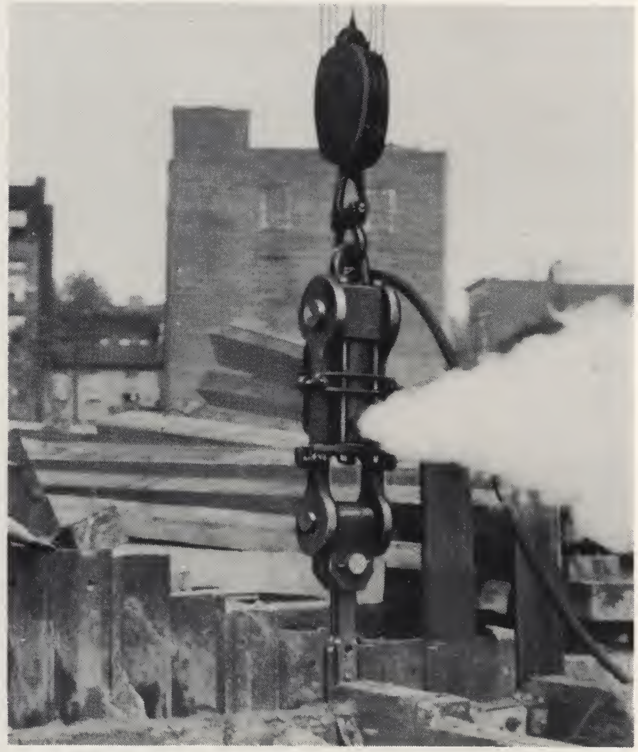
PARTS LIST FOR NO. E-4 PILE EXTRACTOR

No. E-4 Pile Extractor Code Word—RABAL

Part No.	Name	No. Req.	Code Word	Part No.	Name	No. Req.	Code Word
E-401	Top Head	1	RABEM	E-414	Bottom Head	1	RACLA
E-402	Tie Rod	4	RABIN	E-415	Tie Rod Nut	4	RACME
E-403	Anvil	1	RABKA	E-416	Yoke	1	RACNI
E-404	Cylinder	1	RABLE	E-417	Yoke Pin	1	RACOR
E-405	Side Strap	2	RABMI	E-418	Pile Clamp Pin	1	RACPO
E-406	Side Strap Guide Bolt and Nut	4	RABNO	E-419	Spacer	1	RACRU
E-407	Ram	1	RABOP	E-420	Pile Clamp	2	RACSY
E-408	Chest Cover Stud and Nut	4	RABPU	E-421	Pile Clamp Bolt	2	RACUS
E-409	Chest Cover	2	RABRY	E-422	Taper Pin	1	RADNE
E-410	Chest Stud and Nut	4	RABUR	E-423	Side Strap Clamp	2	RADEP
E-411	Valve	1	RACAN	E-424	Cylinder Liner	1	RADAN
E-412	Valve Chest	1	RACEN	E-425	Liner Dowel	1	RADIR
E-413	Piston Ring	1	RACIP				

CONTROLLED PULLING POWER

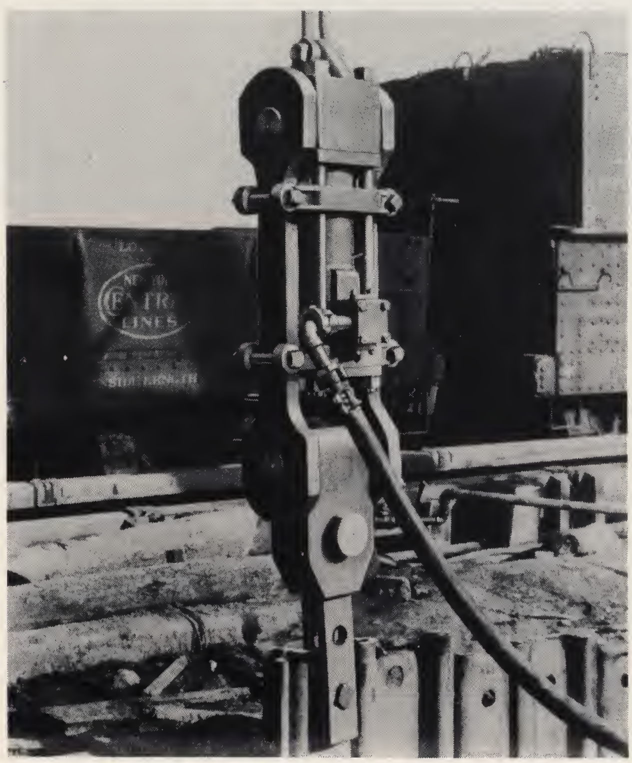


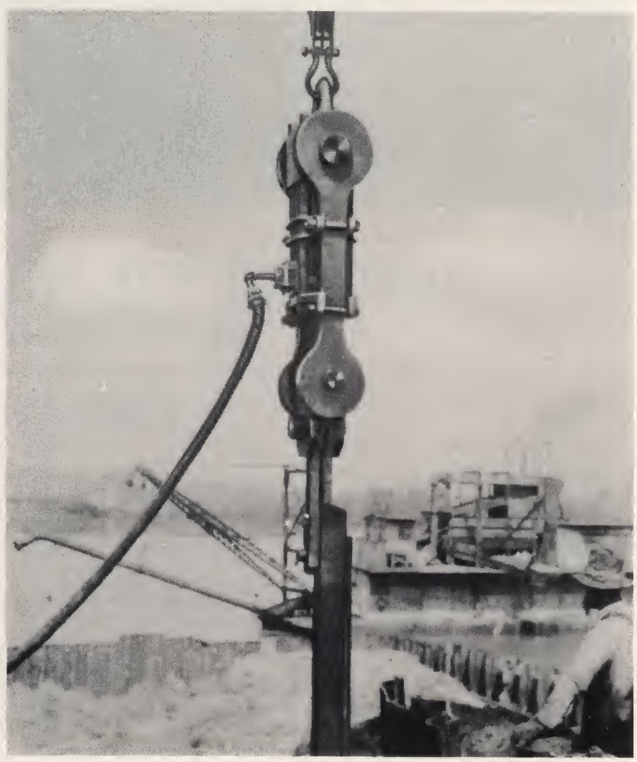


(Above) New York City. McKiernan-Terry No. E-4 Double-Acting Pile Extractor removing steel sheet piling used in the construction of the East River Drive. Contractor, Merritt-Chapman & Scott Corp.

(Below, left) New York City. McKiernan-Terry No. E-2 Double-Acting Pile Extractor, attached to a piece of steel sheet piling, ready to start driving upwards. Its powerful upward pull dislodges piling that otherwise would be most difficult to move. On the job here illustrated, only one bolt is being used to connect extractor to sheeting; where pulling is more difficult another hole in the pile and two-pile bolt connection are used.

(Below, right) East St. Louis. McKiernan-Terry No. E-4 Double-Acting Extractor pulling steel sheet piling driven as ,a retaining wall in constructing a large municipal storm sewer. G. L. Tarlton, Inc., contractor.





COMPLETELY MODERN SINGLE-ACTING PILE HAMMERS

For driving into very dense substances such as stiff blue clay, heavy "gumbo", incipient shale, hard pan, compacted gravel, etc., as well as for driving heavy mass piles — jobs where the benefit of the high-frequency blows of a double-acting pile hammer is not particularly advantageous — McKiernan-Terry Single-Acting Pile Hammers are meeting the most exacting operating conditions.

This modern development in single-acting hammers actually embodies over half a century of research, study, experiment and field operation. While the name McKiernan-Terry has always been closely identified with the double-acting type of hammer, the Company has also, through the years, been building a certain number of single-acting hammers to meet special needs. As long ago as 1934 McKiernan-Terry produced single-acting pile hammers for operations in the development of Pearl Harbor.

That valuable experience, together with the experience gained in many years of producing constantly improved double-acting hammers, has been the background for the introduction of the completely modern single-acting pile hammers described on the following pages.

Operators know that in driving heavy mass piles, such as concrete, and driving where the soil offers severe resistance, a hammer must deliver heavy blows with a heavy-mass ram, but at a lower rate of speed in feet-per-second travel of ram at point of impact than is usual with double-acting hammers.

The single-acting principle makes possible the use of very heavy rams with the minimum amount of boiler horsepower or compressed air. Furthermore, the ram has large striking area — double that of the usual single-acting hammer — thus distributing the blow over a greater area, greatly increasing its effectiveness and reducing wear of the ram and anvil. The same principles of control that govern the constant, uniform strokes of McKiernan-Terry Double-Acting Hammers are employed in the Single-Acting Hammers.

In batter work, McKiernan-Terry Single-Acting Pile Hammers deliver more evenly distributed, more effective blows than has been hitherto possible with single-acting hammers. The bottom cylinder is an all-enclosing guide for the ram.

The valve assembly — often called "the heart of the hammer" — is similar to the very efficient valve assembly used in McKiernan-Terry Double-Acting Hammers. It has a double-contact, sliding-type oscillating action and is completely enclosed against entrance of grit, sand or other foreign matter always present on a pile driving job. This greatly reduces wear. The entire hammer mechanism, in fact, is enclosed. No working parts are exposed, thus reducing operating hazards.

McKiernan-Terrys are the only single-acting hammers that can be operated under water. Thus shorter piles can be used, conserving labor, material and expense. This underwater feature alone puts McKiernan-Terry Single-Acting Pile Hammers in a class by themselves.

VITAL McKIERNAN-TERRY SINGLE-ACTING FEATURES

1. Built of highest quality heat-treated alloy steel forgings and heat-treated alloy steel castings. Steam cylinders of cast meehanite, that strong, close-grained metal famous for long wear. Welded steel bottom cylinders.
2. The only single-acting hammers than can perform underwater work.
3. Completely enclosed — all working parts protected from sand, grit, foreign matter.
4. No exposed working parts — reducing hazards to workers.
5. Piston and ram are heat-treated alloy steel forgings. Ram has larger striking area — making for less wear and fatigue on striking end of ram — making blows more effective.
6. Anvils are heat-treated steel castings, supported to hammer by cables, facilitating quick change.
7. Double-contact, sliding type, oscillating valve mechanism—smooth action—no impact on valve.
8. Easy to disassemble — parts separate into self-contained units.
9. Strokes are constant — all blows uniform in energy.
10. Operate on either steam or air, without change, except in lubrication.
11. More effective for batter work — better fitting guides distribute blows more evenly.
12. Backed by engineering development since 1897.

One of two McKiernan-Terry No. S-14 Single-Acting Pile Hammers believed to be the heaviest ram hammers yet constructed. Used for driving 192-foot steel H-beam piles to 85 feet under water in the construction of the 10,050-foot Potomac River bridge at Ludlow Ferry, Md. See pages 4, 105, 106 and 107 for other pictures. Total weight, hammer and anvil, 31,800 lbs. Ram alone 14,000 lbs. Overall height 16 feet 7 inches.

WORLD'S LARGEST PILE HAMMER

The giant McKiernan-Terry S-14 Single-Acting Pile Hammer shown on the opposite page was designed and built to handle a series of specific and difficult problems in pile driving. Not the least of these was the penetration of difficult substances.

A stratum of rock at a fairly uniform depth of 190 feet below the surface of the river was overlaid by 10 to 20 feet of stiff, sandy clay. Above this was a layer of stiff clay 10 to 40 feet thick, topped with sand and sand-clay mixture to a depth of 25 to 75 feet. And all was topped with 26 to 40 feet of exceedingly soft river mud. The depth of water ranged from 1 foot to 11 feet under the trestle to 11 to 74 feet beneath the bridge proper.

It was obvious that this type of river bottom was such as to nullify the value of the high-frequency blows of a *double-acting* hammer. Through this dense, resistant soil, steel sheet piling ranging from 92 to 192 feet in length must be driven to refusal.

The special McKiernan-Terry No. S-14 Single-Acting Hammer shown here was ordered for the job — in fact, two of these hammers. Capable of delivering a steady, flat blow of 37,500 foot-pounds, these hammers were the largest ever built. The floating pile driver from which they were operated was likewise the largest ever constructed. See photo on page 105.

With this massive equipment a total of 37 miles of piling, including some of the longest piles ever used in bridge piers, were driven to form the long trestle approaches and the bridge's twenty piers. Extra long, telescoping leads permitted driving the tops of piles to 85 feet below water level, to support the pier platforms. This is one more example of the effectiveness of McKiernan-Terry hammers for—

UNDERWATER PILE DRIVING

On page 68 you will find information about the use of McKiernan-Terry Hammers for underwater driving. This information applies not alone to McKiernan-Terry Double-Acting Hammers, but also to the Single-Acting Hammers described in the following pages. Pages 69 to 75 show photographs of underwater driving done with McKiernan-Terry Double-Acting Hammers.

Detailed information about McKiernan-Terry Single-Acting Hammers, with photographs showing them at work, will be found on the pages immediately following.

SPECIFICATIONS OF McKIERNAN-TERRY SINGLE-ACTING HAMMERS

HAMMER SIZE	S-3	S-5	S-8	S-10	S-14
Bore, inches	10½	14	17	17½	20
Stroke, feet	3	3¼	3¼	3¼	2⅔
Blows per minute	65	60	55	55	60
Energy per blow, foot-pounds	9,000	16,250	26,000	32,500	37,500
Size boiler required, (boiler h.p. at 12 sq. ft. of heating surface per boiler h.p.)	25	40	60	65	90
Compressed air required, actual cubic feet	400	600	850	1,000	—
Steam or air pressure required at hammer, pounds per sq. in. (See Note D)	80	80	80	80	100
Recommended steam pressure at boiler, or air pressure at compressor, pounds per sq. in. (See Note D)	100	100	100	100	125
Minimum size hose openings and connections from boiler, or compressor to hammer, inches	1½	2	2½	2½	3
Size of exhaust opening in hammer, inches	3	3½	4	4	5
Code word for hammer	KUZIH	KUZKU	KUZLY	KUZOK	KUZUL

WEIGHTS — POUNDS

	S-3	S-5	S-8	S-10	S-14
Net weight, with flat or bell (cup) anvil, hammer only, pounds	9,030	12,460	18,300	22,380	31,700
Shipping weight, hammer and fittings, pounds	10,150	13,775	19,713	23,793	33,100
Weight of ram, pounds	3,000	5,000	8,000	10,000	14,000
Cup anvil, Type 2, page 88	800	1,400	1,650	2,250	3,300
Flat anvil, Type 1, page 88	800	1,375	1,600	2,200	3,200
H-beam anvil, Type 3, page 88, approx.	900	1,500	1,750	2,500	3,400
Sheet piling anvil, Type 3, page 88, approx.	900	1,500	1,750	2,500	3,400
Anvil for smooth butt concrete piles, Type 5, page 88, approx.	1,400	1,900	2,700	3,200	6,000
Anvil for concrete piles with extended reinforcing rods, Type 6, page 88	Depends on size and number of rods and their length above pile butt				
Anvil for pipe piles, Type 4, page 88, approx.	940	1,550	1,900	2,700	3,600
For shipping weights, add to above net weights, approx.	+100	+150	+200	+200	+300

DIMENSIONS

	S-3	S-5	S-8	S-10	S-14
A—Length, center of sheave to bottom of hammer	11′-4″	12′-2″	13′-3″	13′	13′-7″
B—Top of sheave to bottom of flat anvil	12′-4″	13′-3″	14′-4″	14′-1″	14′-10″
C—Width	20″	24″	26″	30″	36″
D—Depth, without rope lugs	26″	30″	32″	36″	36″
E—Center line of hammer to rear of hammer	16″	18″	19″	21″	21″
F—Maximum depth	32″	36″	38″	42″	42″
G—Maximum stroke	3′-3″	3′-6″	3′-6″	3′-6″	3′
H—Diameter of piston	11″	14″	17″	17½″	20″
I—Anvil—large diameter of recess (See page 88)	17″	20″	22″	26″	28″
J— " —Small diameter of recess (See page 88)	13″	16″	18″	22″	28″
K— " —max. dimensions, flat anvil (See page 88)	20″	24″	26″	30″	36″
Cubic measurements, hammer with flat anvil, inches	30x34x160	36x38x174	38x38x183	43x43x180	48x43x192

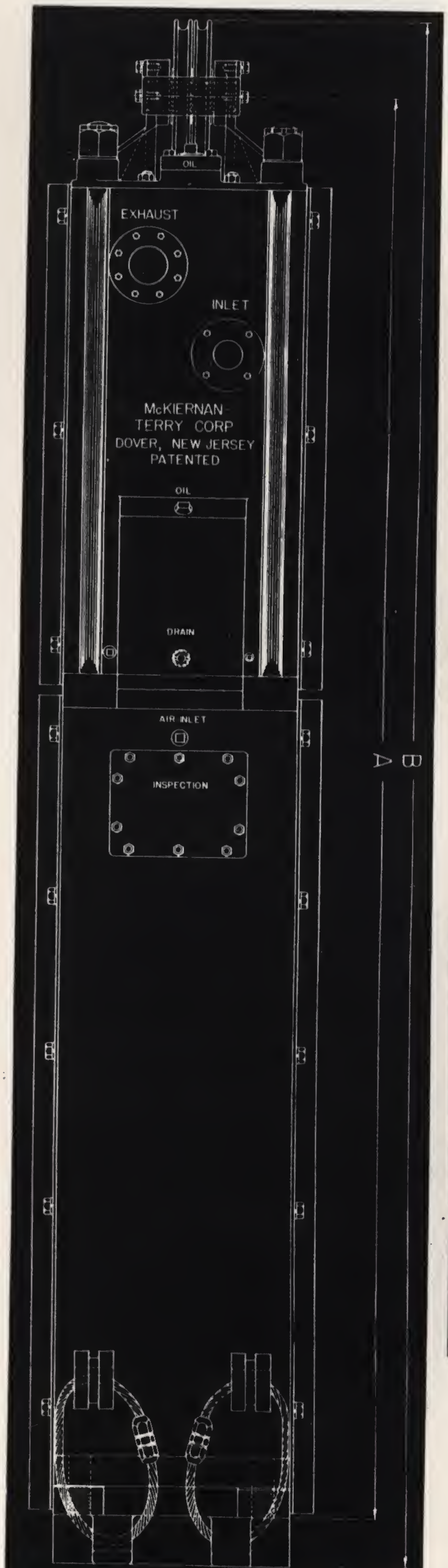
NOTES: A—When ordering, be sure to specify whether hammer is to be operated with AIR or STEAM, so that lubricator of proper type may be furnished.

B—When ordering hammer specify whether a standard flat or bell (cup) anvil is wanted. If other types of anvil or drive cap are required, these will be furnished at additional cost, after receipt of complete specifications of piling to be driven.

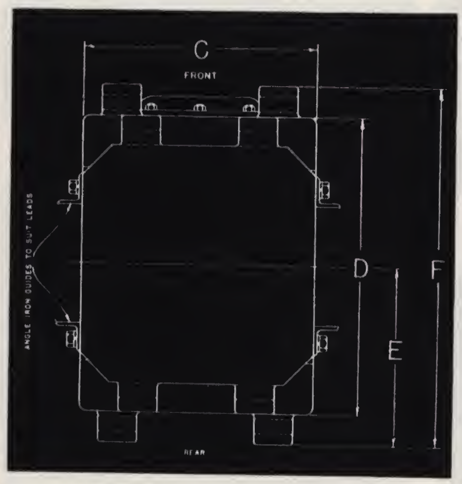
C—If angle iron guides are to be attached, give lead measurements A and B, as indicated on page 92.

D—Figures for steam pressure at hammer and at boiler are approximate, given as a guide. Actual pressures required will vary with the weather, and with the installation of the boiler, length of steam line from boiler to throttle valve, and length of hose used. The actual steam pressure and volume must be regulated by means of the throttle valve and by varying the steam pressure at the boiler so that hammer will run at speed indicated in table. Hammers must not be run faster than rated speed, nor, at such speed that the hammer is lifted off the pile on the up-stroke of the ram.

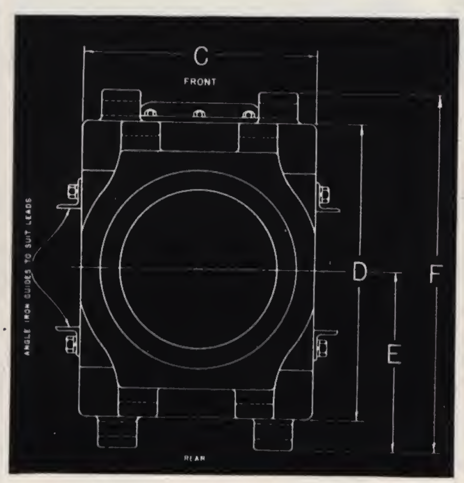
DIMENSIONS OF McKIERNAN-TERRY SINGLE-ACTING HAMMERS



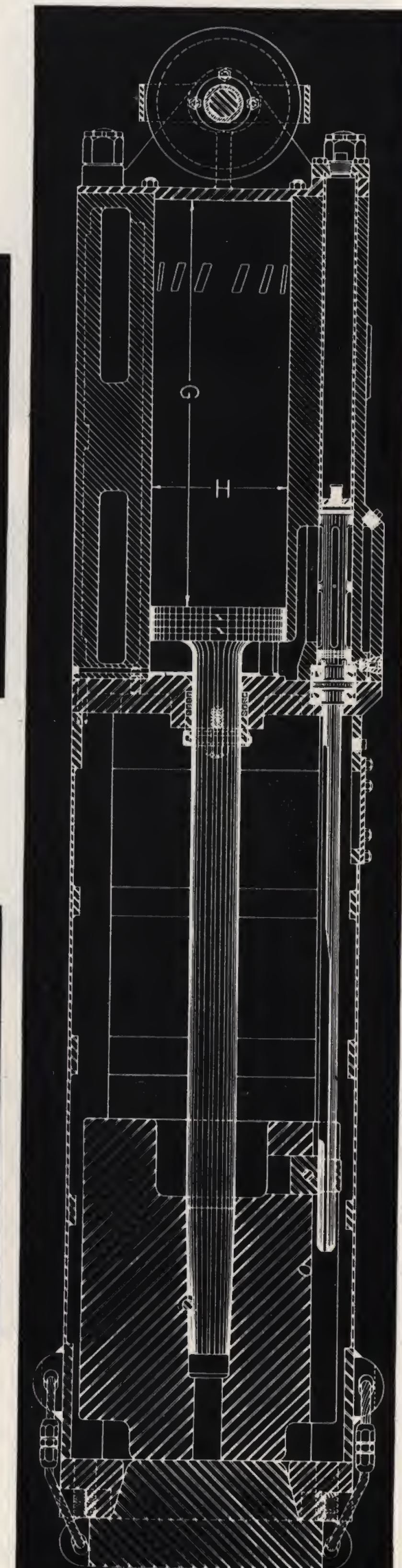
Front elevation



Bottom view, showing flat anvil

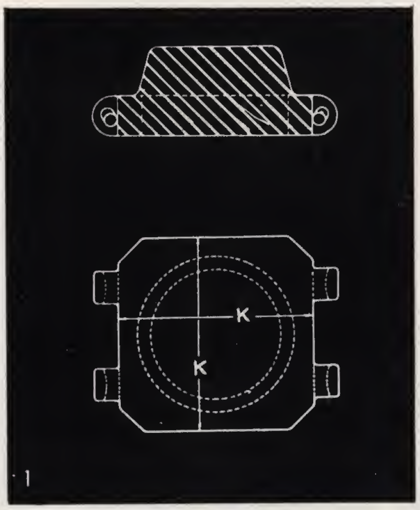


Bottom view, showing cup anvil

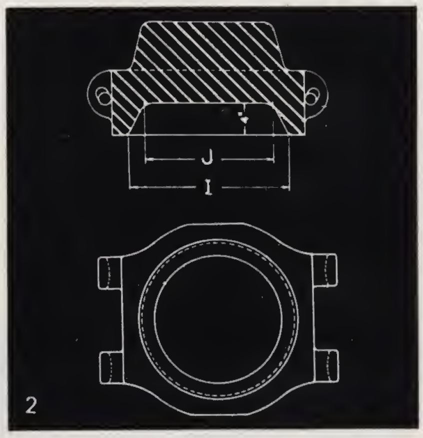


Side sectional elevation

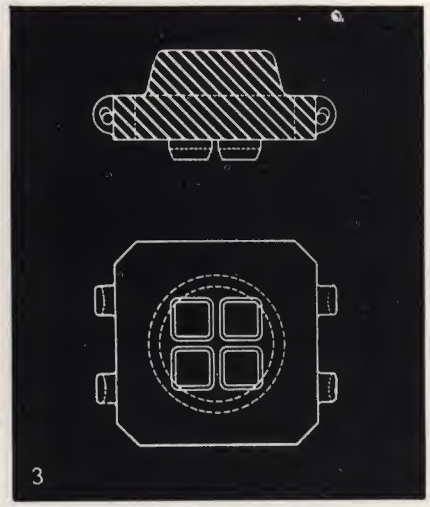
ANVILS FOR McKIERNAN-TERRY SINGLE-ACTING HAMMERS



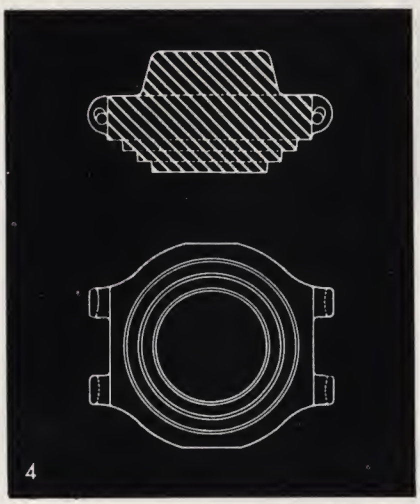
For general use.



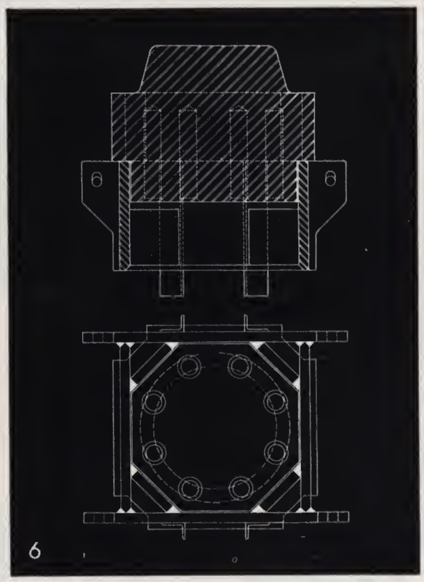
For wood piles.



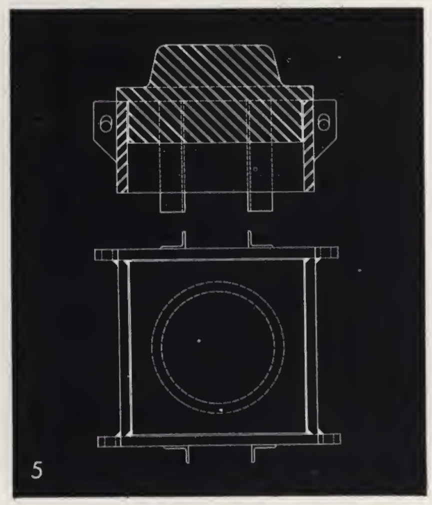
For steel H-beam or sheet piling. Grooves to suit piles.



For pipe piles; size to suit piles.



For concrete piles with extended reinforcing rods. Holes to suit rods.



For smooth butt concrete piles. Size and shape to suit octagonal or square piles.

LARGEST PILE SIZES TO BE USED WITH STANDARD ANVILS

Piles larger than shown in table require special anvils, wider than the width of the hammer. Leads must be wide enough to fit these special anvils.

SIZE OF HAMMER	S-3	S-5	S-8	S-10	S-14
Concrete piles—octagon or square. Special anvils furnished to fit any length, size or number of reinforcing rods, extending beyond butt of pile, inches	16	20	22	26	32
Steel pipe piles—outside diameter, inches	20	24	26	30	32
Wood piles—inside diameter of cup. Larger piles must be chamfered to fit cup, inches	13	16	18	22	28
H-beams—inches	24	27	30	36	36
Steel sheet piling—grooves made to suit piling			All sizes		
Concrete sheet piles			All sizes		

FORMULA FOR COMPUTING BEARING CAPACITY

OF PILES DRIVEN BY SINGLE-ACTING PILE HAMMERS

The "Engineering News" formula given below is simplest formula used by engineers to determine the safe bearing capacity of piles driven by McKiernan-Terry Single-Acting Pile Hammers.

$$L = \frac{2\,WH}{S + .1}$$

In this formula,

L = Safe bearing capacity of pile in pounds.
W = Weight of ram in pounds.
H = Stroke, or fall, in feet.
S = Set, or penetration, of pile in inches per blow.
.1 = Constant

The assumed safety factor of this formula is 6.

The following illustration of the use of this formula is based on the No. S-5 McKiernan-Terry Single-Acting Pile Hammer running at 60 blows per minute, developing a 16,250-foot-pound blow:

$$L = \frac{2\,(5000 \times 3.25)}{S + .1} = \frac{2 \times 16{,}250}{S + .1} = \frac{32{,}500}{S + .1}$$

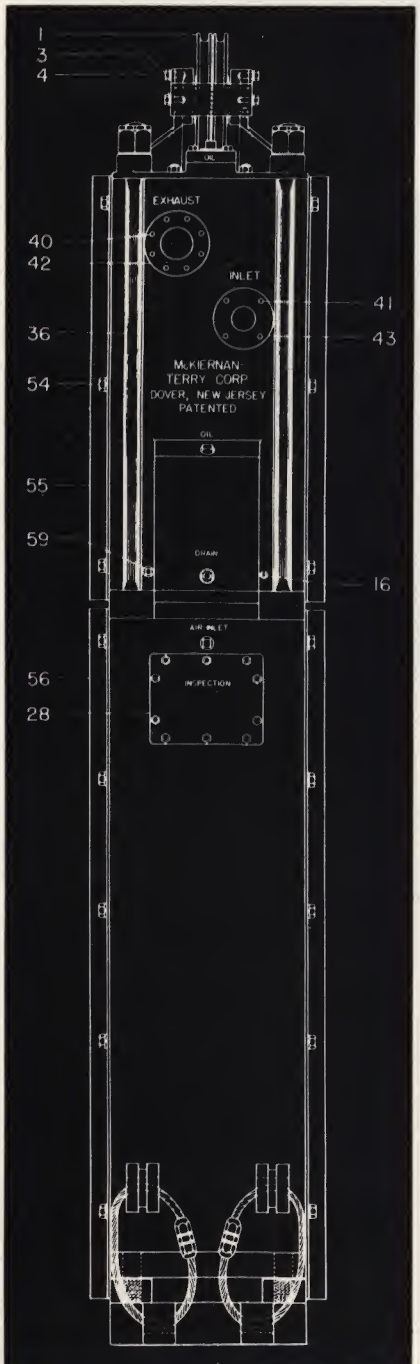
BEARING CAPACITY OF PILES DRIVEN BY McKIERNAN-TERRY SINGLE-ACTING PILE HAMMERS

Based on the "Engineering News" Formula

Penetration or Set per blow Inches (S)	No. S-3 at 9,000 ft. lbs. per blow	No. S-5 at 16,250 ft. lbs. per blow	No. S-8 at 26,000 ft. lbs. per blow	No. S-10 at 32,500 ft. lbs. per blow	No. S-14 at 37,500 ft. lbs. per blow
.1	90,000	162,500	260,000	325,000	375,000
.2	60,000	108,333	173,333	216,667	250,000
.3	45,000	81,250	130,000	162,500	187,500
.4	36,000	65,000	104,000	130,000	150,000
.5	30,000	54,166	86,666	108,333	125,000
.6	25,714	46,428	74,285	92,857	107,143
.7	22,500	40,625	65,000	81,250	93,750
.8	20,000	36,111	57,778	72,222	83,333
.9	18,000	32,500	52,000	65,000	75,000
1.0	16,363	29,545	47,272	59,090	68,182

PARTS FOR McKIERNAN-TERRY

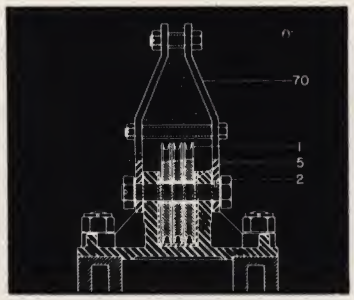
When ordering parts, be sure to give hammer size and, if possible, serial number of hammer.



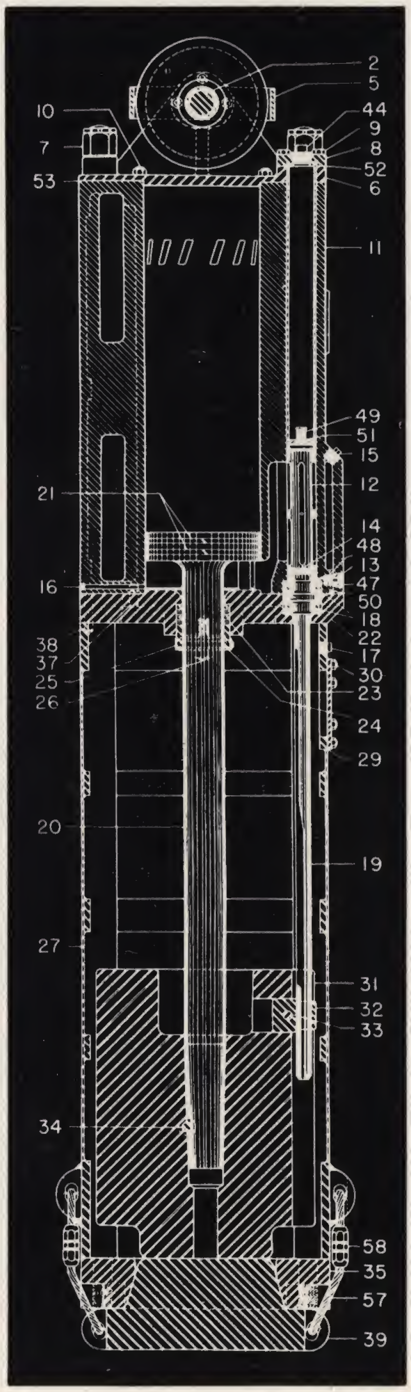
Name of Part	S-3 HAMMER Part No.	No. Req.	Code
Sheave (16″ diameter)	S-3-1	2	LABAH
Sheave Shaft	S-3-2	1	LABEK
Wire Rope Guard Cap Screw	S-3-3	4	LABGA
Wire Rope Guard Lock Washer	S-3-4	4	LABHE
Wire Rope Guard	S-3-5	1	LABIL
Top Head	S-3-6	1	LABKI
Tie Rod Nut	S-3-7	4	LABLO
Oil Reservoir	S-3-8	1	LABNY
Oil Reservoir Stud and Nut	S-3-9	4	LABOM
Top Head Stud and Nut	S-3-10	6	LACAK
Top Cylinder	S-3-11	1	LACEL
Valve	S-3-12	1	LACHA
Oil Strainer for Cam Rod Bearing	S-3-13	1	LACIM
Valve Ring	S-3-14	2	LACKE
Oil Plug, 1¼ inch	S-3-15	1	LACLI
Drain Plug	S-3-16	2	LACMO
Air Inlet Plug	S-3-17	1	LACON
Cam Rod Bearing	S-3-18	2	LACPY
Cam Rod	S-3-19	1	LACUP
Piston	S-3-20	1	LADAL
Piston Ring	S-3-21	2	LADEM
Intermediate Head	S-3-22	1	LADIN
Packing	S-3-23	4	LADKA
Gland	S-3-24	1	LADMI
Gland Cap Screw	S-3-25	2	LADNO
Gland Stud and Nut	S-3-26	2	LADOP
Bottom Cylinder	S-3-27	1	LADPU
Hand Hole Cover	S-3-28	1	LADRY
Hand Hole Cover Gasket	S-3-29	1	LADUR
Hand Hole Cover Stud and Nut	S-3-30	10	LAFAM
Ram	S-3-31	1	LAFEN
Cam Throw	S-3-32	1	LAFIP
Cam Throw Taper Pin	S-3-33	1	LAFLA
Ram Taper Pin	S-3-34	1	LAFME
Bottom Head	S-3-35	1	LAFNI
Tie Rod	S-3-36	4	LAFOR
Dowel Pin for Top Cylinder	S-3-37	2	LAFPO
Dowel Pin for Bottom Cylinder	S-3-38	2	LAFRU
Exhaust Flange Stud and Nut	S-3-40	4	LAFSY
Inlet Flange Stud and Nut	S-3-41	4	LAFUS
Exhaust Flange Gasket	S-3-42	1	LAGAN
Inlet Flange Gasket	S-3-43	1	LAGEP
Oil Plug, 2 inch	S-3-44	1	LAGIR
Exhaust Flange, 3 inch	S-3-45	1	LAGMA
Inlet Flange, 2 inch	S-3-46	1	LAGNE
Housing for Oil Strainer (Cam Rod Bearing)	S-3-47	1	LAGOS
Plug for Oil Strainer (Valve ½″ Allen)	S-3-48	1	LAGPI
Oil Strainer (Valve)	S-3-49	1	LAGRO
Plug for Oil Strainer Hole (¼″ Allen)	S-3-50	1	LAGSU
Gasket for Oil Strainer	S-3-51	1	LAGTY
Oil Reservoir Gasket	S-3-52	1	LAGUT
Top Head Gasket	S-3-53	1	LAHAP
Angle Iron Guide Cap Screw & Lock Washer	S-3-54	36	LAHER
Angle Iron Guide (Top)	S-3-55	4	LAHIS
Angle Iron Guide (Bottom)	S-3-56	4	LAHNA
Cable for Anvil Block	S-3-57	4	LAHOT
Cable Clamp	S-3-58	4	LAHPE
Exhaust Drain Plug	S-3-59	1	LAHRI
Flat Anvil for General Use, Type 1	S-3-60		LAHSO
Cup Anvil for Wood Piles, Type 2 — See Page 88	S-3-61		LAHTU
Anvil for H-beam or Sheet Piling, Type 3	S-3-62		LAHVY
Anvil for Pipe Piles, Type 4	S-3-63		LAKAR
Anvil for Smooth Butt Concrete Piles, Type 5	S-3-64		LAKIT
Anvil for Concrete Piles with Reinforcing Rods Extending above Butts, Type 6	S-3-65		LAKPA
Becket Assembly Complete	——		

SINGLE-ACTING PILE HAMMERS

S-5 HAMMER			S-8 HAMMER			S-10 HAMMER			S-14 HAMMER		
Part No.	No. Req.	Code	Part No.	No. Req.	Code	Part No.	No. Req.	Code	Part No.	No. Req.	Code
S-5-1	2	LAKRE	S-8-1	2	LATID	S-10-1	2	LEDAM	S-14-1	3	LENEX
S-5-2	1	LAKSI	S-8-2	1	LATOF	S-10-2	1	LEDEN	S-14-2	1	LENIZ
S-5-3	4	LAKTO	S-8-3	4	LATUG	S-10-3	4	LEDIP	—	—	—
S-5-4	4	LAKWY	S-8-4	4	LATZA	S-10-4	4	LEDLA	—	—	—
S-5-5	1	LALAS	S-8-5	1	LAVAC	S-10-5	1	LEDME	S-14-5	1	LENOB
S-5-6	1	LALET	S-8-6	1	LAVBA	S-10-6	1	LEDNI	S-14-6	1	LENUC
S-5-7	4	LALRA	S-8-7	4	LAVCE	S-10-7	4	LEDOR	S-14-7	4	LENVA
S-5-8	1	LALSE	S-8-8	1	LAVDI	S-10-8	1	LEDPO	S-14-8	1	LENWE
S-5-9	4	LALTI	S-8-9	4	LAVED	S-10-9	4	LEDRU	S-14-9	4	LENXI
S-5-10	8	LALUX	S-8-10	6	LAVFO	S-10-10	8	LEDSY	S-14-10	11	LENZO
S-5-11	1	LALVO	S-8-11	1	LAVGU	S-10-11	1	LEDUS	S-14-11	1	LEPAX
S-5-12	1	LALXY	S-8-12	1	LAVHY	S-10-12	1	LEFAN	S-14-12	1	LEPBO
S-5-13	1	LAMAT	S-8-13	1	LAVIF	S-10-13	1	LEFEP	S-14-13	1	LEPCU
S-5-14	2	LAMOX	S-8-14	2	LAVOG	S-10-14	2	LEFIR	S-14-14	3	LEPDY
S-5-15	1	LAMSA	S-8-15	1	LAWAD	S-10-15	1	LEFMA	S-14-15	1	LEPEZ
S-5-16	2	LAMTE	S-8-16	2	LAWCA	S-10-16	2	LEFNE	S-14-16	2	LEPIB
S-5-17	1	LAMZY	S-8-17	1	LAWDE	S-10-17	1	LEFOS	S-14-17	1	LEPOC
S-5-18	2	LANAV	S-8-18	2	LAWEF	S-10-18	2	LEFPI	S-14-18	2	LEPUD
S-5-19	1	LANBY	S-8-19	1	LAWFI	S-10-19	1	LEFRO	S-14-19	1	LEPWA
S-5-20	1	LANIX	S-8-20	1	LAWGO	S-10-20	1	LEFSU	S-14-20	1	LEPXE
S-5-21	2	LANOZ	S-8-21	2	LAWHU	S-10-21	2	LEFTY	S-14-21	2	LEPZI
S-5-22	1	LANTA	S-8-22	1	LAWIG	S-10-22	1	LEFUT	S-14-22	1	LERAZ
S-5-23	4	LANWI	S-8-23	4	LAWKY	S-10-23	4	LEGAP	S-14-23	4	LERBI
S-5-24	1	LANXO	S-8-24	1	LAWOH	S-10-24	1	LEGIS	S-14-24	1	LERCO
S-5-25	2	LANZU	S-8-25	2	LAXAF	S-10-25	2	LEGNA	S-14-25	2	LERDU
S-5-26	2	LAPBU	S-8-26	2	LAXDA	S-10-26	2	LEGOT	S-14-26	4	LEREB
S-5-27	1	LAPCY	S-8-27	1	LAXEG	S-10-27	1	LEGPE	S-14-27	1	LERFY
S-5-28	1	LAPEX	S-8-28	1	LAXFE	S-10-28	1	LEGRI	S-14-28	1	LERIC
S-5-29	1	LAPIZ	S-8-29	1	LAXGI	S-10-29	1	LEGSO	S-14-29	1	LEROD
S-5-30	10	LAPOB	S-8-30	10	LAXHO	S-10-30	10	LEGTU	S-14-30	10	LERUF
S-5-31	1	LAPUC	S-8-31	1	LAXIH	S-10-31	1	LEGVY	S-14-31	1	LERXA
S-5-32	1	LAPVA	S-8-32	1	LAXKU	S-10-32	1	LEHAR	S-14-32	1	LERZE
S-5-33	1	LAPWE	S-8-33	1	LAXOK	S-10-33	1	LEHES	S-14-33	1	LESAB
S-5-34	1	LAPXI	S-8-34	1	LAXUL	S-10-34	1	LEHIT	S-14-34	1	LESBE
S-5-35	1	LAPZO	S-8-35	1	LAZAG	S-10-35	1	LEHPA	S-14-35	1	LESCI
S-5-36	4	LARAX	S-8-36	4	LAZEH	S-10-36	4	LEHRE	S-14-36	4	LESDO
S-5-37	2	LARBO	S-8-37	2	LAZFA	S-10-37	2	LEHSI	S-14-37	2	LESEC
S-5-38	2	LARCU	S-8-38	2	LAZGE	S-10-38	2	LEHTO	S-14-38	2	LESFU
S-5-40	8	LARDY	S-8-40	8	LAZHI	S-10-40	8	LEHWY	S-14-40	8	LESGY
S-5-41	4	LAREZ	S-8-41	4	LAZIK	S-10-41	4	LEKAS	S-14-41	8	LESID
S-5-42	1	LARIB	S-8-42	1	LAZKO	S-10-42	1	LEKET	S-14-42	1	LESOF
S-5-43	1	LAROC	S-8-43	1	LAZLU	S-10-43	1	LEKRA	S-14-43	1	LESUG
S-5-44	1	LARUD	S-8-44	1	LAZMY	S-10-44	1	LEKSE	S-14-44	1	LESZA
S-5-45	1	LARWA	S-8-45	1	LAZOL	S-10-45	1	LEKTI	S-14-45	1	LETAC
S-5-46	1	LARXE	S-8-46	1	LEBAK	S-10-46	1	LEKUX	S-14-46	1	LETBA
S-5-47	1	LARZI	S-8-47	1	LEBEL	S-10-47	1	LEKVO	S-14-47	1	LETCE
S-5-48	1	LASAZ	S-8-48	1	LEBHA	S-10-48	1	LEKXY	S-14-48	1	LETDI
S-5-49	1	LASBI	S-8-49	1	LEBIM	S-10-49	1	LELAT	S-14-49	1	LETED
S-5-50	1	LASCO	S-8-50	1	LEBKE	S-10-50	1	LELOX	S-14-50	1	LETFO
S-5-51	1	LASDU	S-8-51	1	LEBLI	S-10-51	1	LELSA	S-14-51	1	LETGU
S-5-52	1	LASEB	S-8-52	1	LEBMO	S-10-52	1	LELTE	S-14-52	1	LETHY
S-5-53	1	LASFY	S-8-53	1	LEBON	S-10-53	1	LELUZ	S-14-53	1	LETIF
S-5-54	36	LASIC	S-8-54	36	LEBPY	S-10-54	36	LELVI	S-14-54	44	LETOG
S-5-55	4	LASOD	S-8-55	4	LEBUP	S-10-55	4	LELWO	S-14-55	4	LETUH
S-5-56	4	LASUF	S-8-56	4	LECAL	S-10-56	4	LELZY	S-14-56	4	LEVAD
S-5-57	4	LASXA	S-8-57	4	LECEM	S-10-57	4	LEMBY	S-14-57	4	LEVCA
S-5-58	4	LASZE	S-8-58	4	LECIN	S-10-58	4	LEMEN	S-14-58	4	LEVDE
S-5-59	1	LATAB	S-8-59	1	LECKA	S-10-59	1	LEMIX	S-14-59	1	LEVEF
S-5-60		LATBE	S-8-60		LECMI	S-10-60		LEMOZ	S-14-60		LEVFI
S-5-61		LATCI	S-8-61		LECNO	S-10-61		LEMTA	S-14-61		LEVGO
S-5-62		LATDO	S-8-62		LECOP	S-10-62		LEMXO	S-14-62		LEVHU
S-5-63		LATEC	S-8-63		LECPU	S-10-63		LEMZU	S-14-63		LEVIG
S-5-64		LATFU	S-8-64		LECRY	S-10-64		LENBU	S-14-64		LEVKY
S-5-65		LATGY	S-8-65		LECUR	S-10-65		LENCY	S-14-65		LEVOH
——			——			——			S-14-70		LEVUK



Sheave, sheave stand and Becket arrangement for S-14 only



OPERATING INSTRUCTIONS

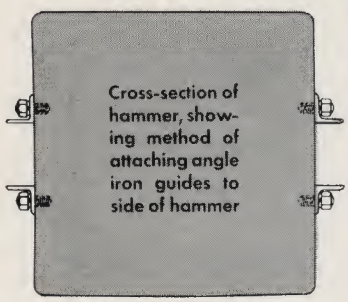
FOR McKIERNAN-TERRY SINGLE-ACTING PILE HAMMERS

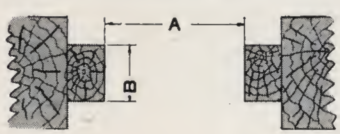
A—LEADS RECOMMENDED

The use of leads to guide the hammer in driving is recommended. Driving without leads usually results in misalignment of the hammer with the pile, causing excessive wear or breakage of the striking end of the ram and the anvil, as well as possible damage to the piling.

B—ATTACHING ANGLE IRON GUIDES

Angle iron guides are furnished with each hammer to guide the hammer in the leads. If it is desired to have these guides attached to the hammer at the factory, this will be done at no additional charge. However, if guides are to be attached at the factory dimension B of your leads must be furnished when ordering the hammer, keeping in mind that dimension A of your leads must be at least ¾ inch greater than the width of the hammer which width is given in dimension table, page 86.


Cross-section of hammer, showing method of attaching angle iron guides to side of hammer



Measurements necessary in specifying angle iron guides

On the other hand, if guides are not required to be attached at the factory, but at a later date it is desired to attach them or any other fixtures to the hammer, it will be necessary to send for dimensional detailed print showing exactly where and how to attach the angle iron guides, at the same time specifying the size hammer to which they are to be attached. The guides should be spaced ½ inch wider back to back than the width B shown in illustration above of the faces of the leads.

The guides are furnished unattached unless the dimension for spacing of the guides is specified when ordering hammer.

Guides are attached to hammer with cap screws so that the rear guides may be removed to facilitate placing the hammer in the leads.

C—HOSE CONNECTIONS

The size hose specified for each hammer should always be used. Use of a smaller size than that specified may result in the hammer not running up to the rated number of blows per minute.

The hose should be connected to the steam inlet flange. Correct fittings, consisting of a nipple and an elbow, are furnished with each hammer. Universal joints for connecting hose to the hammer are recommended, but are not furnished as standard equipment.

Before connecting hose to steam inlet, the hose should be thoroughly blown out with steam or air.

The operation of the hammer will be improved if a drain cock or valve is installed in the steam line as near to the hammer as possible, so that condensed steam may be blown out before starting to drive each pile.

Do not use wornout hose. Pieces of rubber or lining may get blown into the hammer and clog ports or valve.

D—PRECAUTIONS AGAINST WEAR, DAMAGE AND BREAKAGE

1. Use adequate lubrication with the right kind of oil.
2. Keep hammer in line with pile.
3. Keep full weight of hammer on pile while driving.
4. Do not use excessive steam or air pressure, as it will cause hammer to over-stroke and lift off pile on up-stroke.
5. Do not continue to drive on piles at refusal. Continued driving on piles which have stopped moving will damage piles and break hammer parts.
6. Do not use full power of hammer when starting piles or during very easy driving.
7. Keep tie rod nuts tight.

E—STARTING DIRECTIONS

A cold hammer should be warmed up slowly, by cracking the throttle valve and admitting steam or air to the cylinder, so that the hammer will run slowly and the ram make short strokes. In cold weather a large amount of steam will condense in the steam line and hose and inside the hammer. This condensate or water must be worked through the hammer before running hammer at full speed.

When starting a pile and during easy driving, the hammer should be run slowly with short strokes, so that the pile will not be driven out from under the hammer causing damage to the tie rods and drive cap.

The full weight of the hammer must rest on the pile while the pile is being driven. The hoisting line must

be kept slack at all times while the pile is being driven, so that the ram will not strike the retainer and damage the hammer.

Continued operation of the hammer when the full weight of hammer is not resting on the pile will cause breakage of the tie rods and separation of the piston from the ram.

F—DISASSEMBLING HAMMER

To take hammer apart, remove the four tie rod nuts. Lift off top head and top cylinder in one piece. Remove valve from top cylinder. Lift out cam rod. Place eyebolt in top of piston. Lift piston, ram and intermediate head out of bottom cylinder in one piece. Do not remove piston or cam throw from ram unless necessary to make repairs. Reverse above operations to reassemble hammer.

G—PACKING PISTON

Square packing, Garlock #15 or #777, is recommended to pack the piston.

For size S-3 hammer use four rings of 5/8-in. square packing.

For sizes S-5, S-8 and S-10 hammers use four rings of 3/4-in. square packing.

For size S-14 use four rings of 1-in. square packing.

Do not use more than four rings.

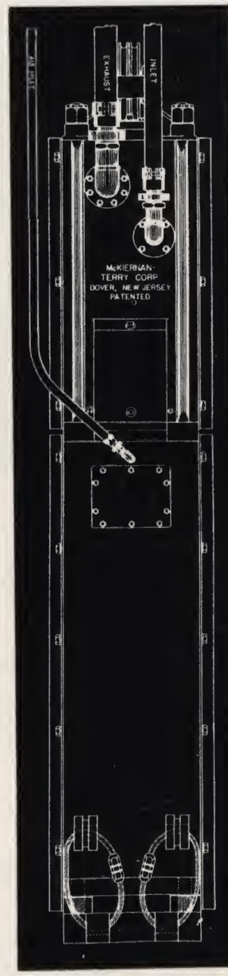
Gland stud nuts should be made up evenly, so that gland will exert even pressure on the packing. Gland should compress packing very lightly. Packing will be kept tight by steam pressure. Severe compression will cause undue wear of packing and hinder free movement of the piston. Gland nuts must be made fast with wire to prevent their working loose when hammer is driving.

H—CARE OF HAMMER IN TRANSIT AND WHEN NOT IN SERVICE

Plug inlet and exhaust to keep dirt out of hammer.

If hammer is to be out of service for a period under three months detach hose and pour one quart of oil down hose. Reattach hose and run hammer for several strokes to flush oil through hammer. Drain water which may have condensed in cylinder by removing drain plugs. Replace plugs to prevent entry of dirt.

If hammer is to be out of service for a period over three months take hammer apart, dry all parts, thoroughly coat them with oil and reassemble.



Air inlet hose attached for underwater driving

I—COLD WEATHER PRECAUTIONS

When hammer is not being used during cold weather, all water should be drained out of the top cylinder by removing drain plugs. Failure to drain cylinder may result in cracking of the cylinder due to freezing.

J—INSTRUCTIONS FOR UNDERWATER DRIVING

Illustration at right shows method of attaching the air inlet hose to bottom cylinder which is necessary for underwater driving with McKiernan-Terry Single-Acting Hammers.

It is highly recommended that a lubricator be placed on the air line connected to the bottom cylinder and the same oil used as suggested for the steam line. (See page 94.)

The exhaust line must be carried to the surface of the water. Use exhaust hose of at least the size recommended in specification table, page 86; but for submergence greater than approximately 15 feet, use even larger hose—as large as possible.

About 60 cubic feet of compressed air per minute is sufficient volume for any size hammer, and about 1/2-lb. pressure for every foot of submergence.

All hose should be kept out of water as much as possible, and free of kinks or bends.

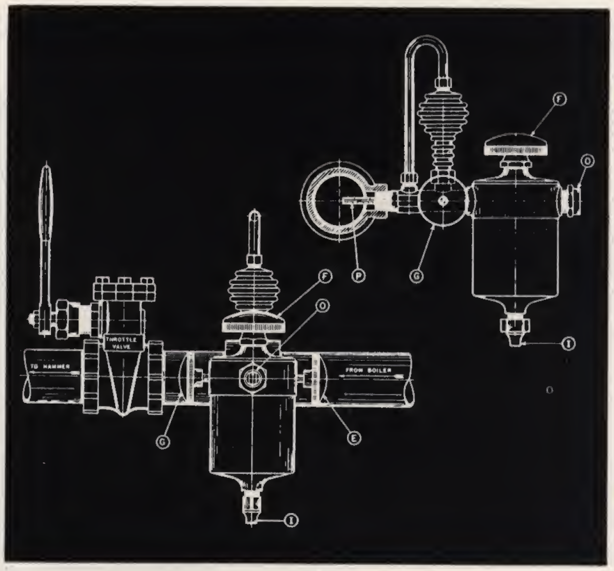
LUBRICATION—PLEASE READ AND FOLLOW CAREFULLY

Adequate lubrication is absolutely necessary for satisfactory operation of McKiernan-Terry Single-Acting Pile Hammers. Insufficient oil or use of the wrong kind of oil causes shutdowns, excessive wear and costly repairs.

All McKiernan-Terry Single-Acting Hammers will operate on either steam or compressed air. No changes, *except in lubrication,* are necessary in changing from steam to air.

K—TO LUBRICATE *STEAM-OPERATED* HAMMERS

A Swift Sight-Feed Lubricator for steam operation — see page 94 — is furnished with each McKiernan-



Sight-feed lubricator for steam operation

Terry Single-Acting Pile Hammer, but any standard sight-feed lubricator, if properly installed and operated, will do.

The purpose of the lubricator is to supply oil to the steam so that it is carried inside the hammer to lubricate piston and steam cylinder. The lubricator should be carefully installed as per directions, and must be kept filled and in operation while the hammer is running.

L—HOW TO INSTALL STEAM LUBRICATOR

The lubricator should be placed on the steam line back of the throttle valve; that is, between throttle valve and boiler. The connection from lubricator to steam line should be made through a tee, with the oil outlet pipe P extending into the center of the steam line.

Be sure that the oil outlet pipe P (see illustration above) *extends all the way into the flow of steam and is at right angles to the flow.*

This is necessary so that steam passing through the line will carry oil in the *center* of the hose and not along the sides.

Never mount lubricator at a bend in the steam line where the flow of steam will strike the oil outlet pipe P head-on, as this will cause lubricator to work intermittently.

M—HOW TO OPERATE STEAM LUBRICATOR

Close valves E and G. Remove filler plug F and fill oil reservoir full to very top, and replace F. The bright nickel-silver plate showing the sight feed O will now be completely covered with oil.

Open valve E about one-half turn, then allow five or ten minutes, on a new installation, for steam to condense and form the water column. Then open valve G very carefully. Drops of water will commence to roll down over the bright plate. Each drop will cause a drop of oil to be forced into the steam line.

Valve G should be regulated to give at least one drop of oil to every ten blows of the hammer. Avoid opening valve G too wide. If water runs in a stream, instead of in drops, oil will be wasted.

When the oil in the reservoir is nearly exhausted water will commence to show at the bottom of sight-feed O, gradually rising and showing on the sight-feed plate. Although there will be still enough oil to run for some time, it is best to refill when the water shows.

To refill reservoir, close valves E and G to shut off lubricator from steam line, open I and remove plug F to drain off water. Then proceed to refill as above. When hammer is not operating, valve G should always be closed.

If the lubricator is connected in such a way as to cause variable pressure, better results can be obtained by closing valve E to about the same opening as valve G, making the adjustment after lubricator has commenced feeding.

If the bright sight-feed plate should become dull or tarnished, a little silver polish on a cloth will quickly restore its original luster.

If lubricator should become clogged from impurities in the oil, remove filler plug F and sight-feed nut O. Then open valves G and E and the steam pressure will clear the passages. Don't fail to do this should lubricator fail to work properly, as dirt in the passages will hinder the working of any lubricator.

In cold weather drain lubricator by opening I whenever hammer is not being used.

N—OIL FOR USE WITH STEAM

Steam hammers are often required to run on wet steam, due to unavoidable operating conditions and the length of steam line and hose between boiler and hammer. Therefore we recommend high grade compounded steam cylinder oil containing 5% to 7% animal oil.

Oil of this type produces an emulsifying effect when in contact with moisture, and the resulting lather resists the tendency of wet steam to wash oil off the internal moving surfaces of the hammer. Oil meeting the following specifications has proved successful under average conditions:

Gravity—degrees API	22-25
Pour Point—degrees Fahrenheit	10-40
Flash Point—degrees Fahrenheit	525-590
Viscosity—Saybolt seconds at 210 degrees	120-140
Percentage of compounded oil—usually acidless tallow or lard	5%-7%

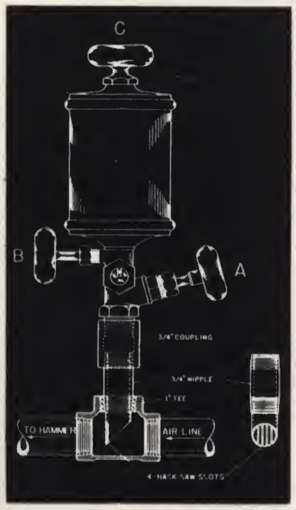
Typical oils meeting these specifications include Socony-Vacuum Gargoyle Cylinder Oil 600-W Regular; Standard Oil of New Jersey Cylesso T-140; Texas Company Honor Cylinder Oil; Gulf Oil Corporation Crystal Cylinder Oil B.

O—TO LUBRICATE *AIR OPERATED* HAMMERS

A Swift Sight-Feed Lubricator for compressed air is supplied with each McKiernan-Terry Single-Acting Hammer, to be used on the air line when hammer is operated on air. It is also used on the air line connected to bottom cylinder when hammer is operated in underwater driving. Note underwater instructions, Section J.

P—HOW TO INSTALL AIR LUBRICATOR

The lubricator should be placed on the steam line back of the throttle valve; that is, between throttle valve and boiler. The connection from lubricator to steam line should be made through a tee, with the oil outlet pipe P extending into the center of the steam line.



Air lubricator

Be sure that the oil outlet pipe P extends all the way into the flow of steam and is at right angles to the flow.

This is necessary so that steam passing through the line will carry oil in the *center* of the hose and not along the sides.

The illustration (left) shows correct method of installing lubricator in air line.

Never mount lubricator at a bend in the steam line where the flow of steam will strike the oil outlet pipe P head-on, as this will cause lubricator to work intermittently.

Q—HOW TO OPERATE AIR LUBRICATOR

Close valves A and B. Remove cover C and fill oil reservoir. Replace cover C and open valve B. Then open valve A very carefully and regulate it to give at least one drop of oil to every ten blows of the hammer. When lubricator needs refilling, close valves A and B, remove cover C and repeat above operation.

It is necessary that a steady supply of oil be fed into the air line whenever hammer is in operation. Operation without oil for even a brief period may cause serious damage to the hammer.

R—OILS FOR USE WITH AIR

The oils recommended for steam operation should not be used when the hammer is operated on air, because they are too heavy and sticky unless heated by steam. Oil of approximately the following specifications is recommended for air-driven hammers:

Gravity—degrees API	17-28
Pour Point—degrees Fahrenheit	0 to −10
Viscosity—Saybolt seconds at 210 degrees	48-60
Percentage of compounded oil	0 to 3%

The following brands of oil have been used successfully in air-driven hammers: Socony-Vacuum Gargoyle D.T.E. Heavy Medium; Gulf Oil Corporation Harmony Oil D or Seneca Oil B; Texas Company Ursa Oil C; Standard Oil of New Jersey Teresso 52.

S—OILS FOR UNDERWATER DRIVING

See instructions for underwater driving, Section J, page 93. Hammers operate on very wet steam under water, due to the cold water in contact with the steam hose and outside surfaces of hammer. This causes steam to condense, with the result that a large amount of water is carried along with the steam.

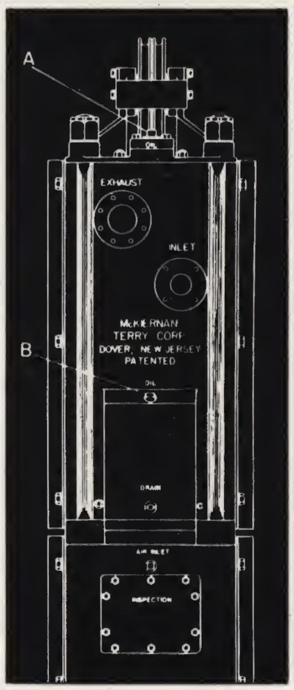
This excess water makes it necessary to use a cylinder oil containing 10% to 12% compound animal oil, in order to insure that oil will adhere to the moving parts.

Socony-Vacuum Gargoyle P. E. Cylinder Oil Dark and similar oils containing 11% compounded lard have proved successful and are recommended for underwater use.

T—INTERNAL LUBRICATION

Oil reservoir A at top of valve and oil reservoir B in the face of the steam cylinder—see illustration at right—should be kept filled with the oil recommended above. Reservoir A oils the valve. Reservoir B oils the cam rod bearings, cam rod, and cam throw.

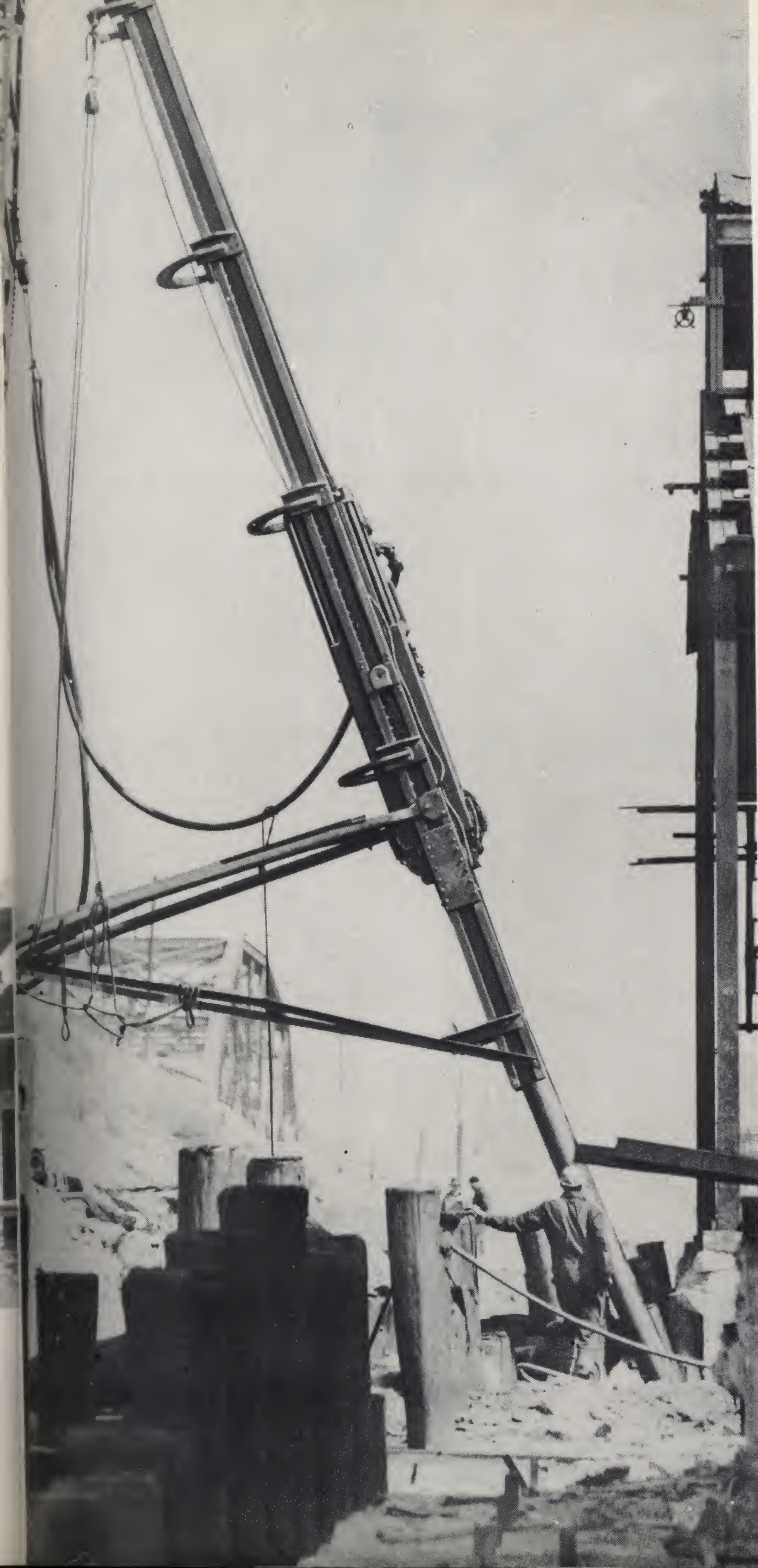
As the oil in these reservoirs drips out steadily, whether the hammer is in operation or not, the reservoirs should be completely filled at start of driving, and refilled at least every hour the hammer is in operation.



Location of oil reservoirs

SINGLE-ACTING HAMMER IN FLORIDA

Miami, Fla. McKiernan-Terry No. S-3 Single-Acting Pile Hammer used in constructing two state highway bridges on the causeway between Miami and Miami Beach. A total of 572 8-inch bearing piles 50 to 96 feet in length were driven. Average depth of water 5 feet. Contractors, Ebsary Foundation Co.



WIDENING A NATIONAL HIGHWAY

Newark, N. J. McKiernan-Terry No. S-3 Single-Acting Hammer driving 25-foot creosoted timber batter piles in the widening of U. S. Route 22 highway crossing meadows south of Newark, E. O. Wickberg, contractor.

HOME PORT FOR DE-ACTIVATED SHIPS

Green Cove Springs, Fla. McKiernan-Terry No. S-5 Single-Acting Hammer driving steel foundation piles for bulkhead docks and piers for deactivated U. S. Navy vessels, at Benjamin Lee Field, on the St. Johns River just below Green Cove Springs. See also opposite page. Contractors, Merritt-Chapman & Scott Corp.

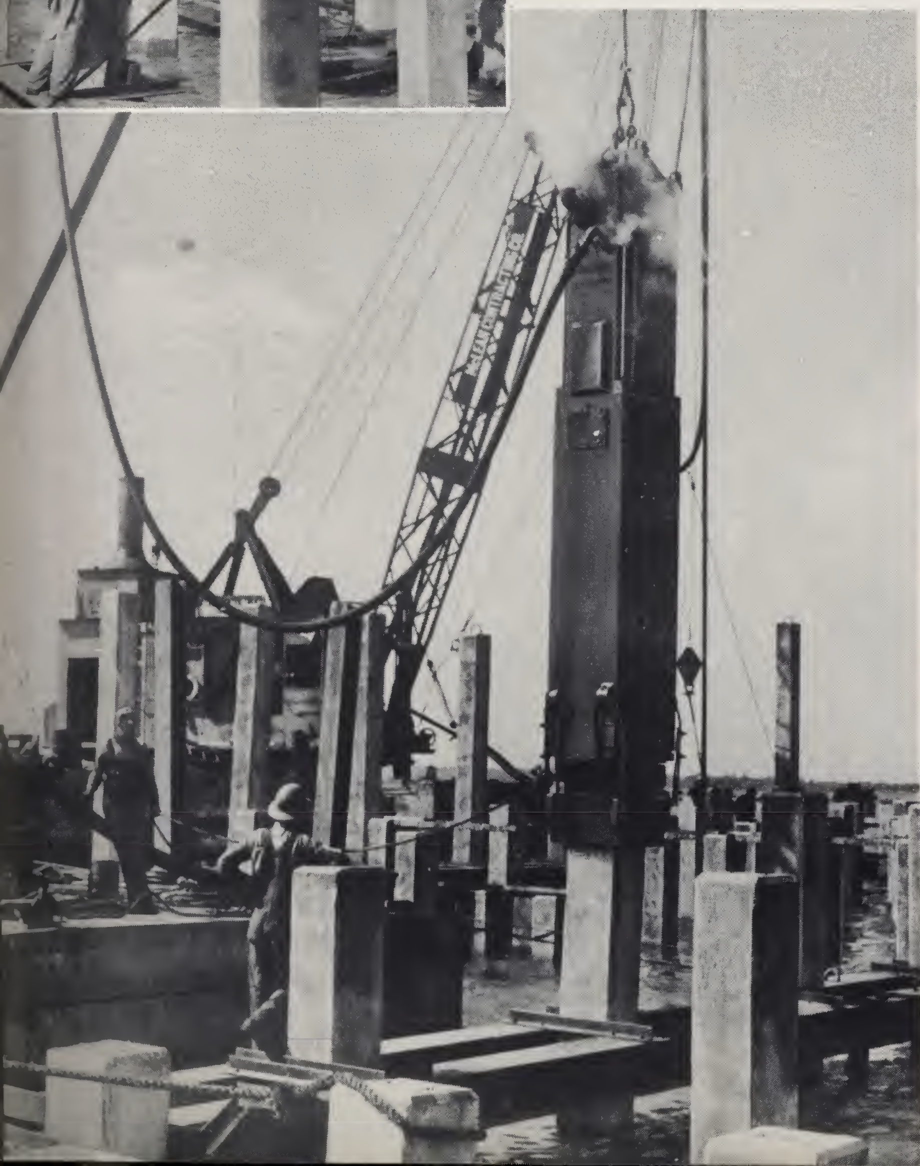
Green Cove Springs, Fla. McKiernan-Terry No. S-5 Single-Acting Hammer driving batter piles in constructing piers at Benjamin Lee Field. See also opposite page. Merritt-Chapman & Scott Corp., contractors.

DRIVING INTO CORAL ROCK

Fort Lauderdale, Fla. McKiernan-Terry No. S-5 Single-Acting Hammer driving 16-inch square concrete piling for Florida State Highway. Piles 35 feet long were driven 25 feet into coral rock. Contractors, Powell Brothers, Inc.

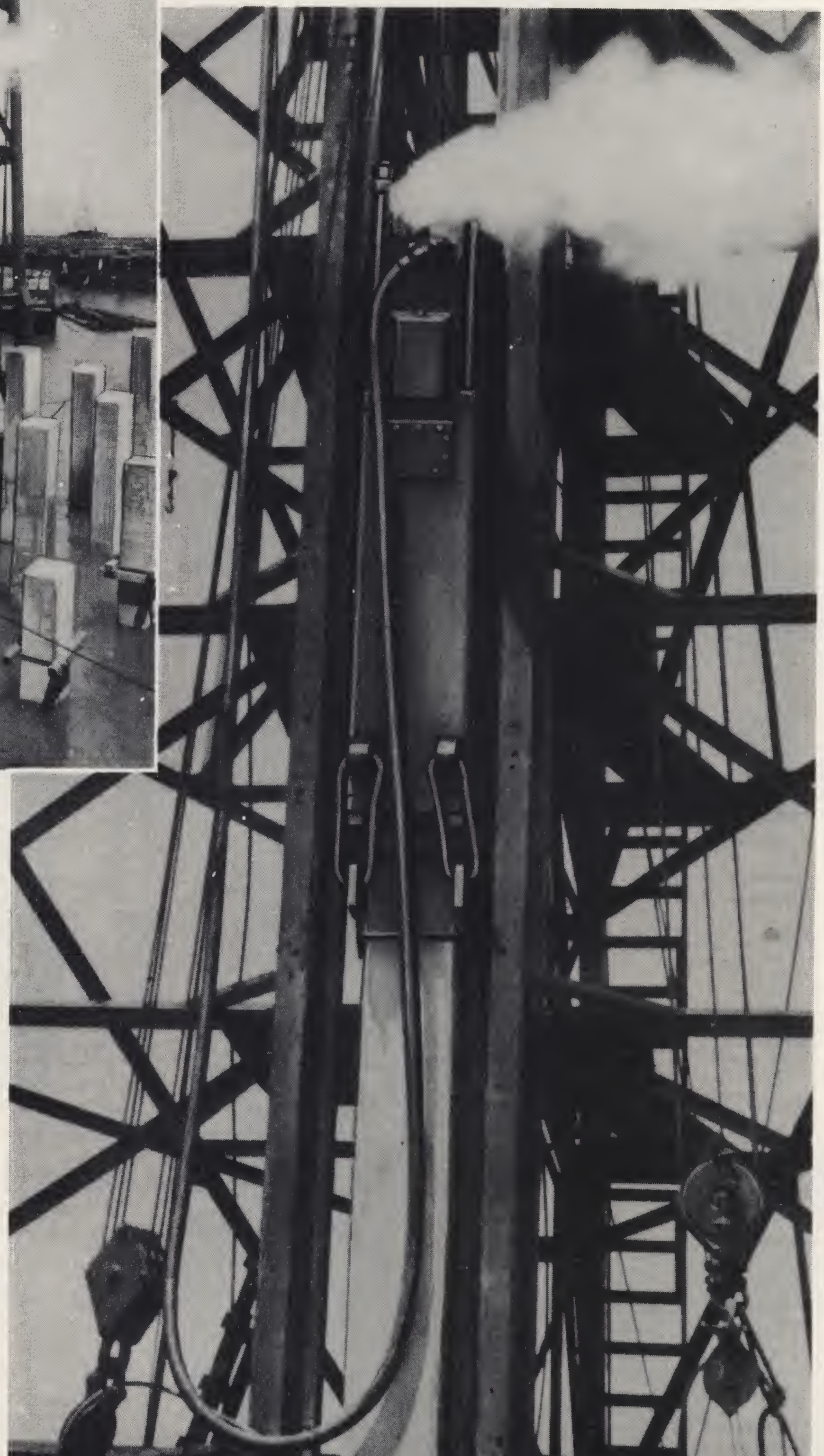
TEN ACRES OF CONCRETE PILES

(Left and below) Norfolk, Va. McKiernan-Terry No. S-8 Single-Acting Hammer drove a total of 5,386 pre-cast concrete piles averaging 14 tons each in constructing this 10-acre cargo and warehouse pier for the Norfolk & Western Railway. McLean Contracting Co., contractors.



REPAIRING A DAMAGED BRIDGE

(Above) Pensacola, Fla. McKiernan-Terry No. S-8 Single-Acting Hammer driving 18-inch square reinforced concrete piling 90 feet long, in repairing the badly damaged Thomas A. Johnson Bridge across Pensacola Bay. A total of 60 piles were driven approximately 60 feet through mud and hard marl to a bearing of 42 tons, all driven to given elevation without any cut-off. Contractors, Hardaway Contracting Co.

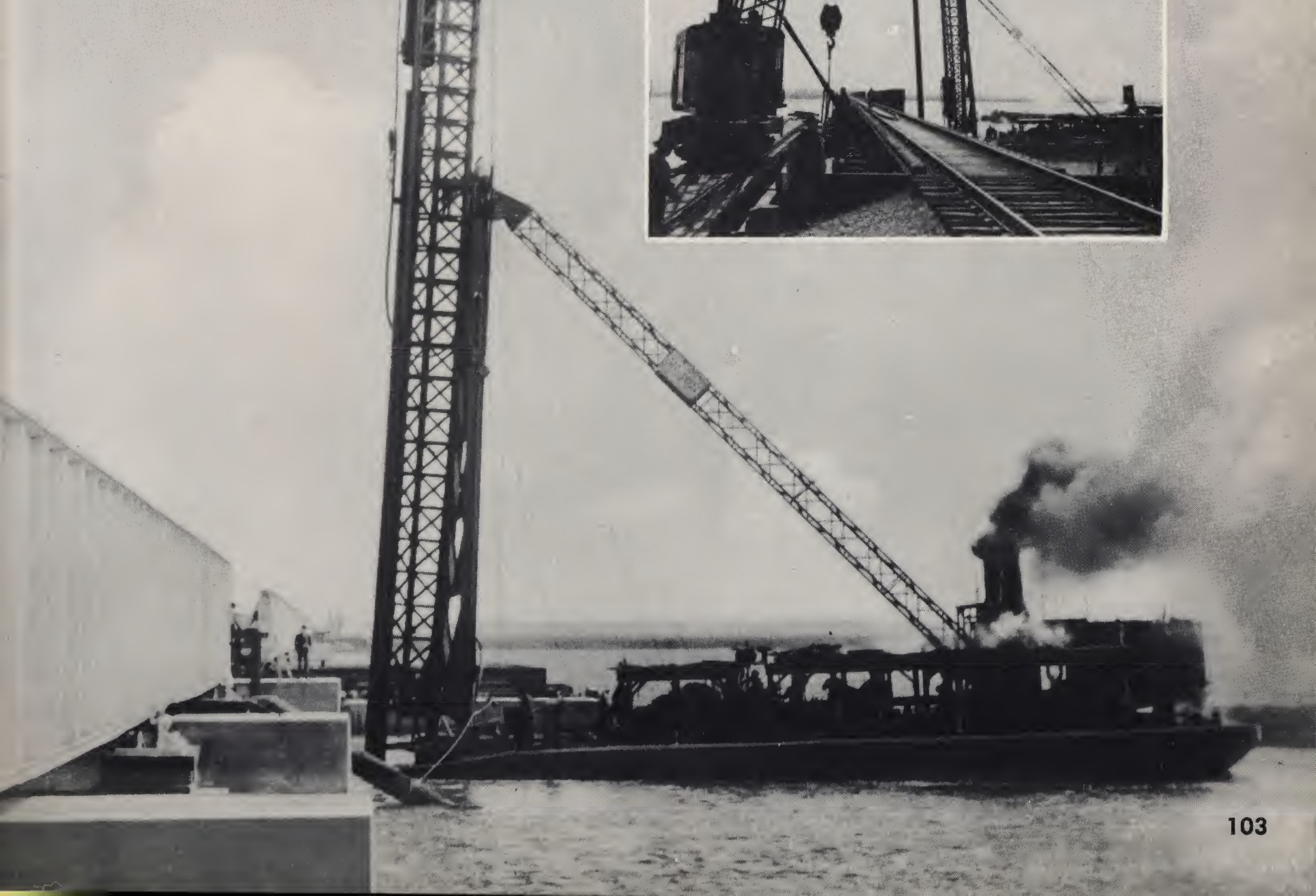


HANDLING LONG CONCRETE PILES

San Francisco, Calif. McKiernan-Terry No. S-8 Single-Acting Hammer driving 18-inch concrete piling 60 to 80 feet long, in the construction of the Mission Rock Pier. Contractor, Clinton Construction Co.

REPLACING TIMBER WITH TUBES

Gautier, Miss. McKiernan-Terry No. S-10 Single-Acting Hammer used in rebuilding the 15-span, single-track Louisville & Nashville Railroad bridge over the West Pascagoula River. Spiral-welded Armco pipe piles were used to replace the original timber piles of the bridge's 16 piers. A total of 256 80-foot piles, 24 inches in diameter, were driven through silt, clay, gravel, into fine sand to penetrations of 64 to 89 feet below water level. Maxon Construction Co., contractors.



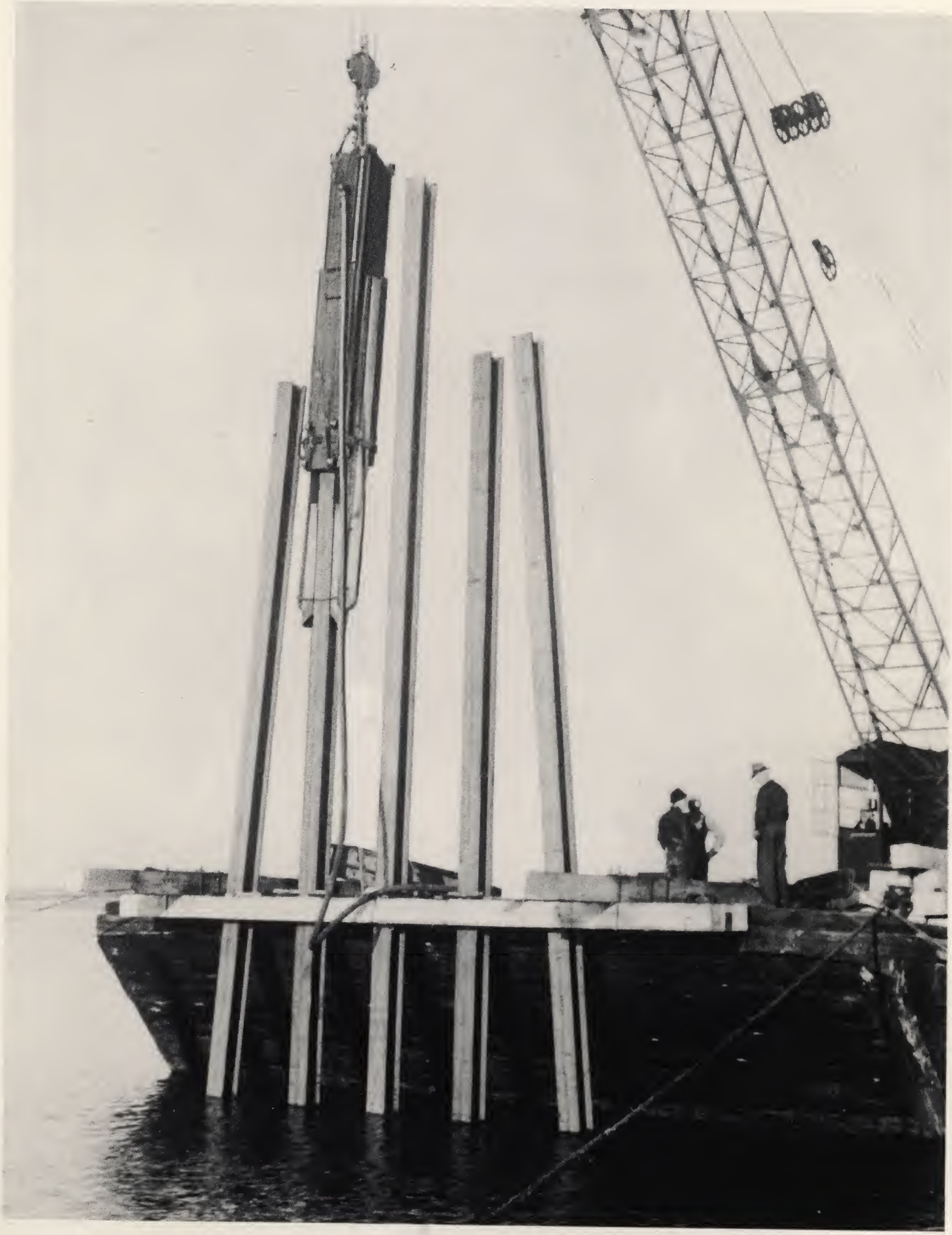
SEVEN POSITIONS PER BENT

Garrison, N. D. McKiernan-Terry No. S-10 Single-Acting Hammer driving 24-inch steel pipe piles for the 1350-foot rail and highway bridge across the Missouri River at Garrison Dam. Operating from a floating rig with universal tilting leads and assembled with steel pontoons, this hammer drove bents of 15 100-foot piles for each of the 8 piers. In each group of piles, 3 were driven vertically, 12 on a 4-to-12 batter in 6 different directions to give maximum stability against scour, ice and floods. At each of the 6 deeper water piers, the 3 downstream piles were driven to a bearing load of 180 tons 70 to 80 feet into glacial till. All other piles were driven to 150 tons bearing. Missouri Valley Construction Inc. and Minston Bros. Co., joint contractors.

WORLD'S LARGEST FLOATING PILE DRIVER

Ludlow Ferry, Md. McKiernan-Terry No. S-14 Single-Acting Hammer, operated from the world's largest floating pile driver, used in the construction of the Potomac River bridge, described on page 85. The 90-foot telescoping leads could be extended 60 feet above the top of tower and 95 feet below deck, permitting pile tops to be driven 85 feet below water level. See also page 107. Merritt-Chapman & Scott Corp., contractors.

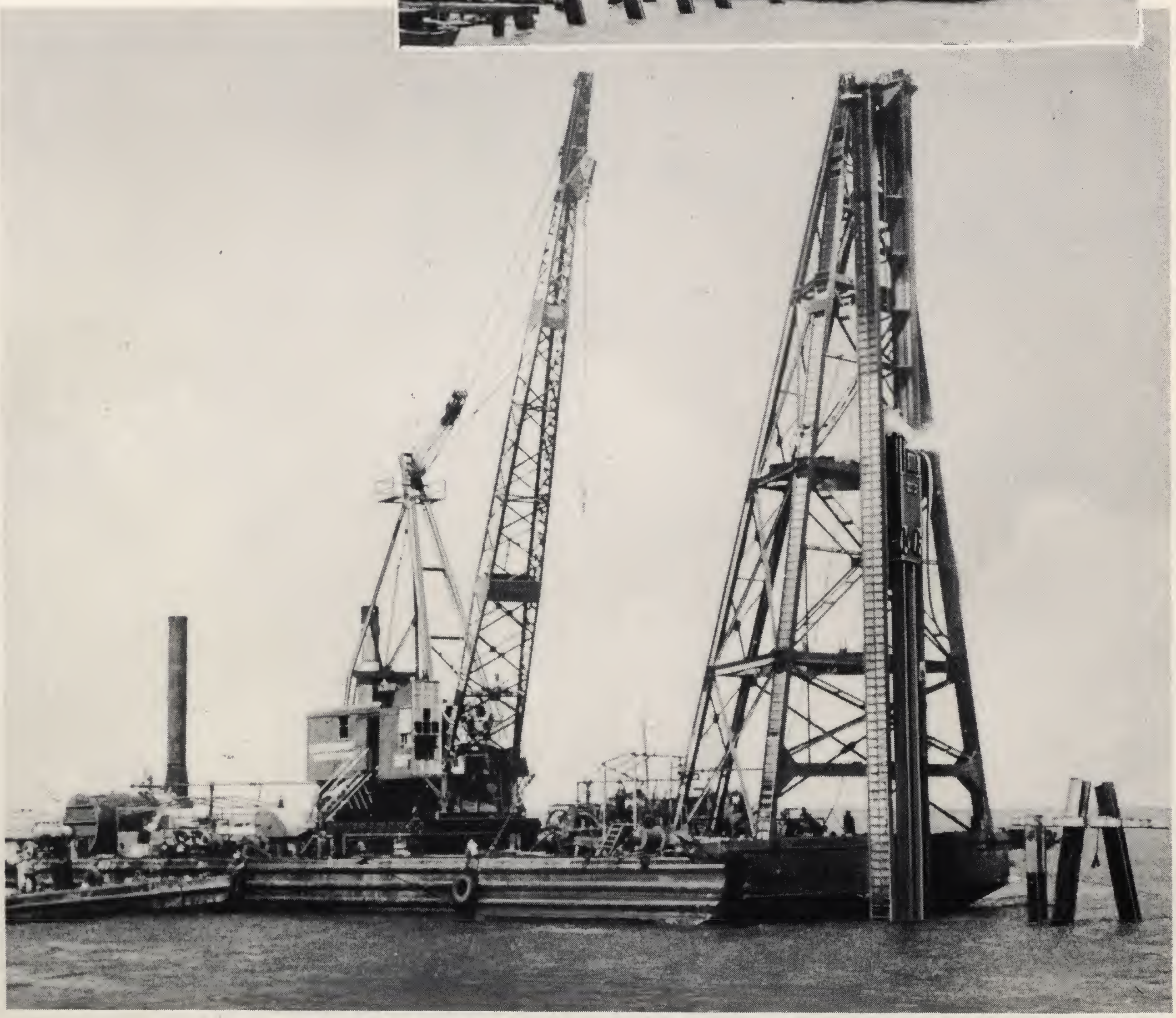
RECORD HAMMER IN ACTION

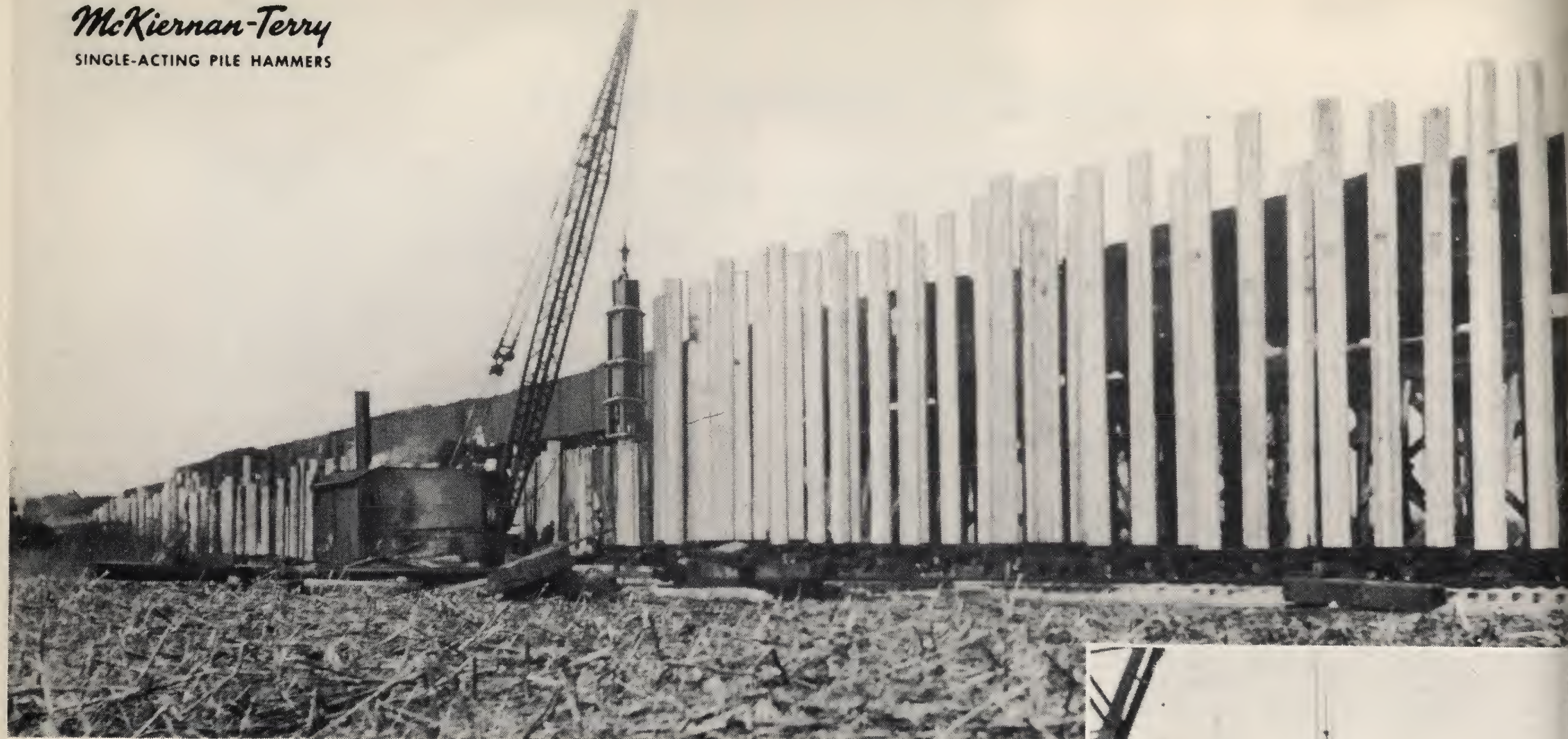


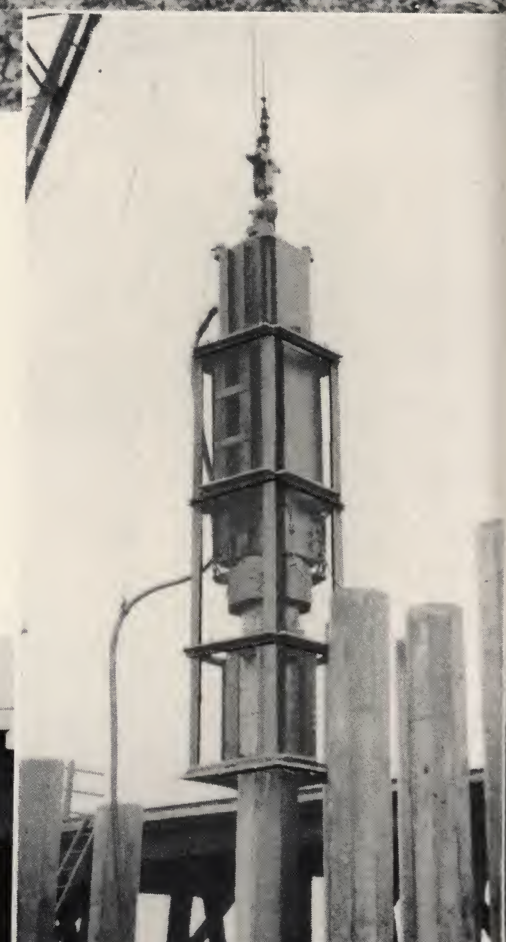
Ludlow Ferry, Md. One of 2 huge McKiernan-Terry No. S-14 Single-Acting Hammers driving steel H-beam bearing piles, ranging in length from 92 to 192 feet, for the 10,050-foot Potomac River bridge linking Maryland and Virginia. See also pages 4, 84, 85, 105 and 107. Merritt-Chapman & Scott Corp., contractors.

BIG HAMMER GOES TO SOUTH AMERICA

Amuay Bay, Venezuela. McKiernan-Terry No. S-14 Single-Acting Hammer engaged in constructing a large pier for the Creole Petroleum Corporation, driving box type piles welded to a length of 100 feet. This hammer, operated from the world's largest floating pile driver, is one of the two huge single-acting hammers described on pages 84 and 85. Merritt-Chapman & Scott Corp., contractors. Photo, Maurey Garber Studio.







OVER TWO MILES OF CONCRETE PILES

Indiana, near Evansville. A McKiernan-Terry No. S-14 Single-Acting Hammer, with 14,000-lb. ram, drove 2224 24-inch octagonal reinforced concrete piles for the major portion of the 11,626-ft., 629-span Indiana approach to the Louisville & Nashville Railroad single-track bridge across the Ohio River at Henderson, Ky., on the main line between St. Louis and Louisville. Replacing an earlier timber structure, 50-ft. concrete piles were driven into sand with some clay and fine gravel, without the use of a jet. After reaching 30-foot penetration, piles were driven until a minimum of 10 blows per inch were required to drive one foot; or if 30-foot penetration were not reached, piles were driven until 12 to 15 blows per inch were necessary for the last foot of penetration. Actual penetration varied from 25 to 35 feet, with a 20-ft. maximum difference per single bent. One remarkable feature of the job was the lack of spalling of concrete at the pile heads. Lower photo shows first train to cross the completed approach —the L. & N. Georgian No. 81. Work was under general direction of C. H. Blackman, chief engineer and J. C. Nichols, bridge engineer, with T. Clouse supervisor of bridges and buildings and J. W. Hoyt, resident engineer in direct charge.

COMPLETE STEEL PILE DRIVING RIGS

AND STEEL LEADS FOR ATTACHMENT TO CRANES

McKiernan-Terry designs, engineers and manufactures complete pile driving rigs for use on land or water, designed for any specified pile driving conditions.

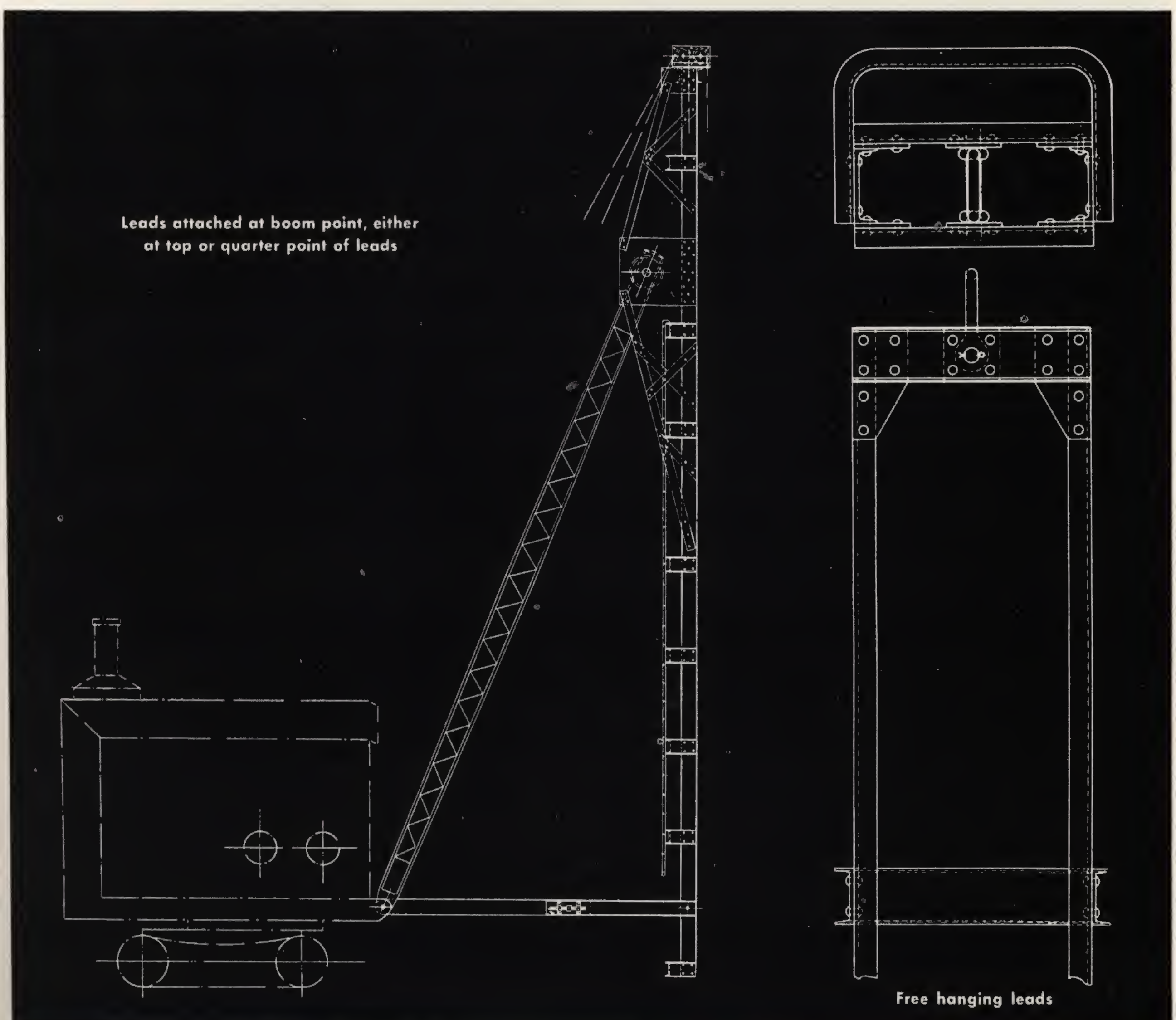
We also manufacture steel pile driver leads for attachment to cranes. We supply these leads for fixed mounting on crane or shovel booms—suspended at boom point from top of leads, or at quarter point on leads extending above boom point, as shown in the lower left hand cut. Or we supply free hanging leads to be hung from a hook over the boom point sheave, as shown in cut at lower right hand corner of page.

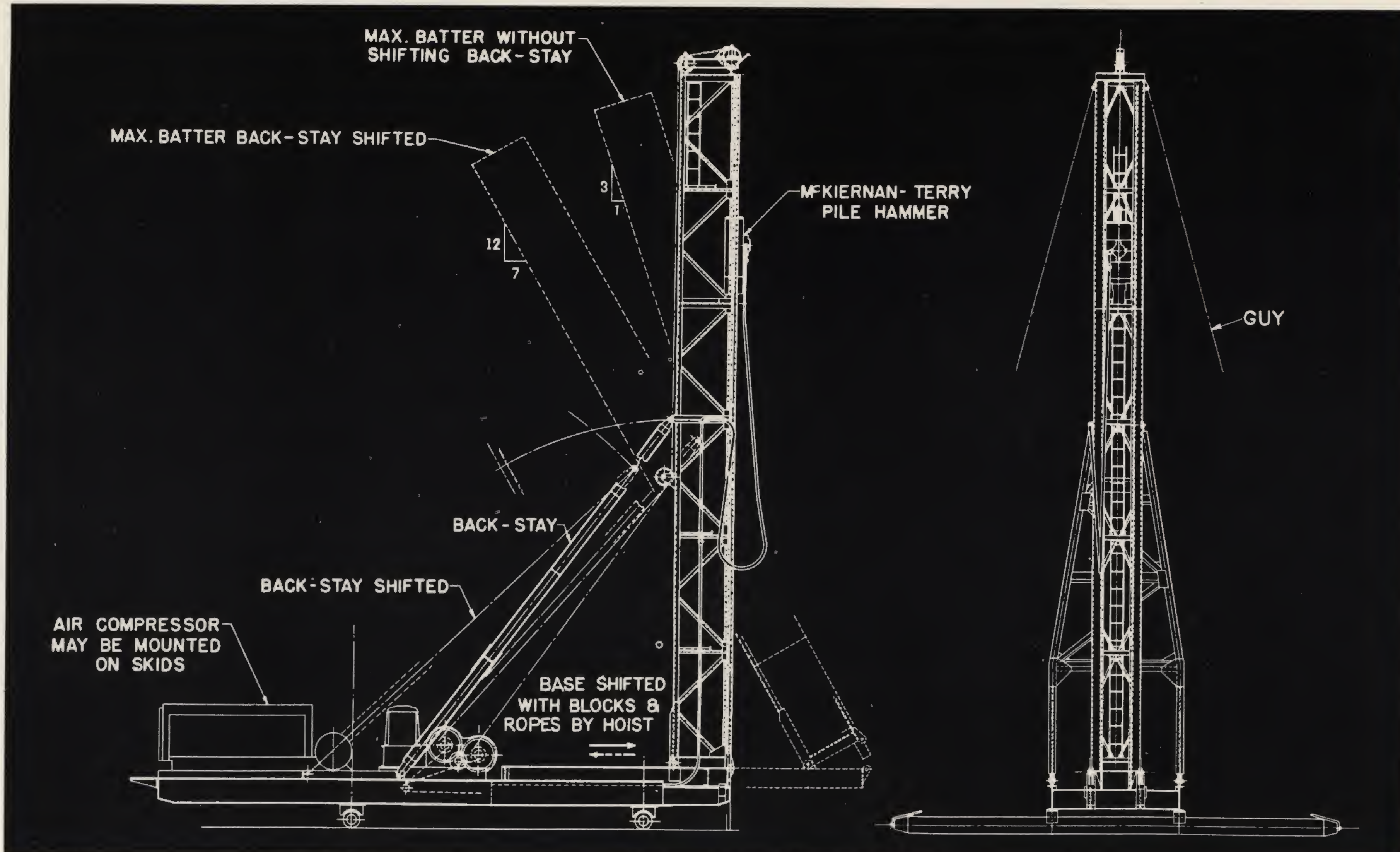
We are prepared to quote for and furnish complete pile driving rigs, as shown in the pages immediately following. These include the following types:

Standard Fixed Leads;
Pendulum Leads;
Portable Pile Driver with Overhanging Leads;
Fore-and-Aft Adjustable Batter Pile Leads;
Full Revolving Pile Driver Leads, Fixed or Pendulum; etc.

Any of the above pile driving rigs are obtainable mounted on skids or rollers or rail mounting for land driving; or barge mounting for water driving. They can also be furnished with telescopic extension for underwater driving.

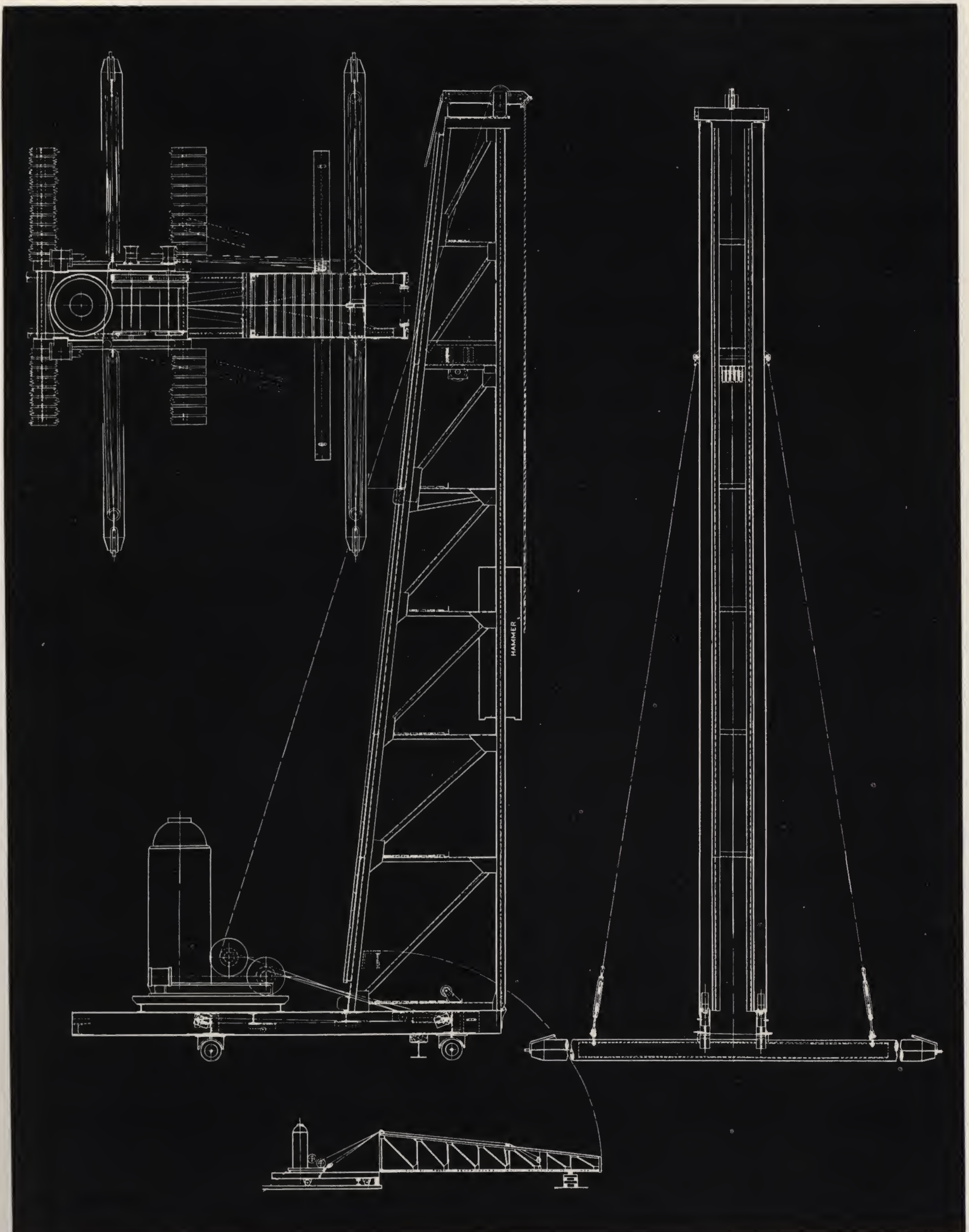
The pages immediately following show a number of different McKiernan-Terry Pile Driving Rigs of varied types, for land and marine driving.





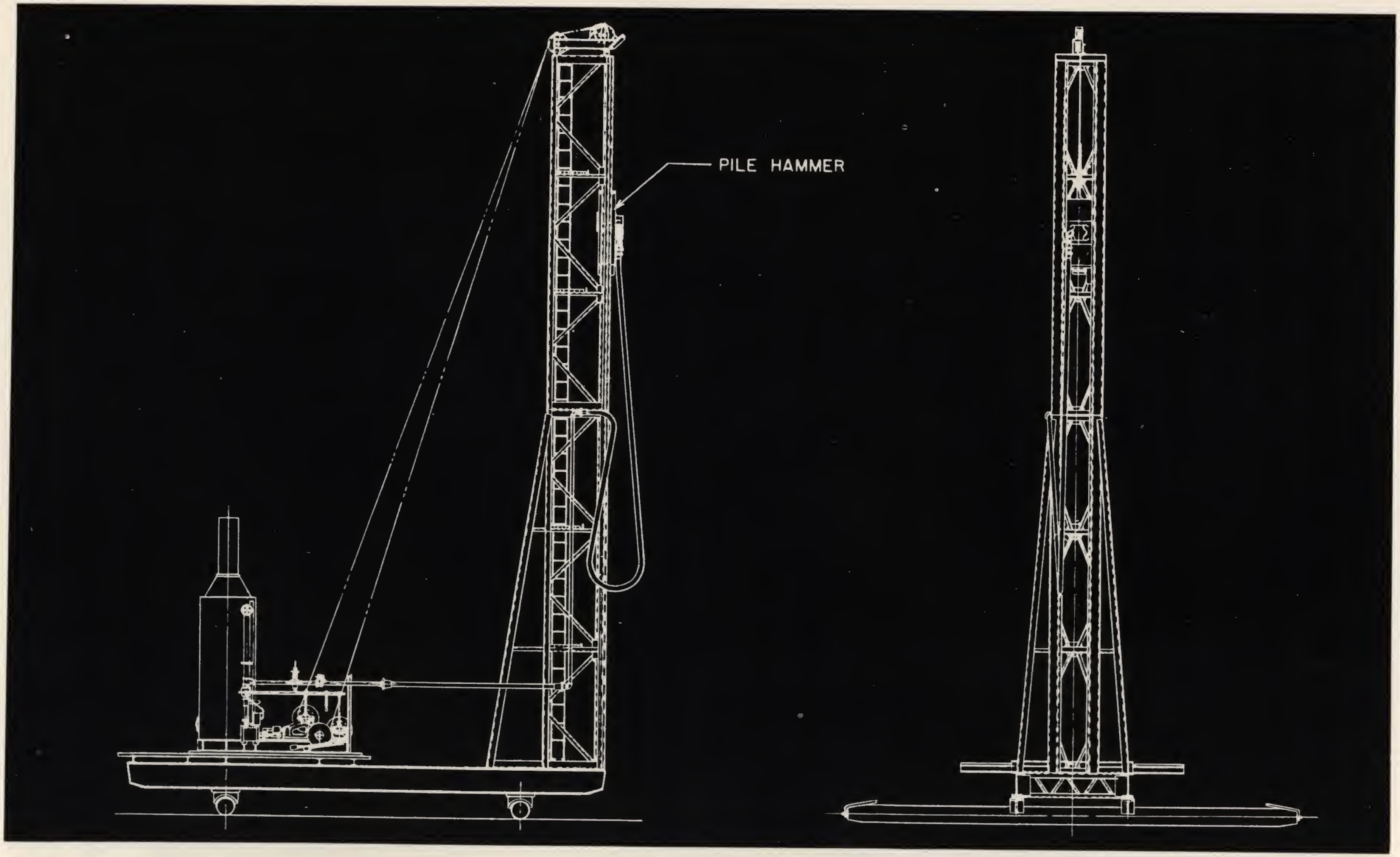
McKIERNAN-TERRY PD-50-1 SKID-MOUNTED PILE DRIVER

Equipped with leads mounted on a sliding platform, which is shuttled forward to provide a batter of 1 to 3, or, when shifting the back-stay to a second hitch point, batter can be increased to 7 to 12. Shown here with gasoline engine-driven hoist and air compressor for operating hammer. Can also be furnished with a conventional steam hoist and boiler. Using a winch head on the hoist and with tackle provided, rig can be rolled fore and aft or skidded sidewise. Heavy-wall steel pipe rollers are oak-filled.



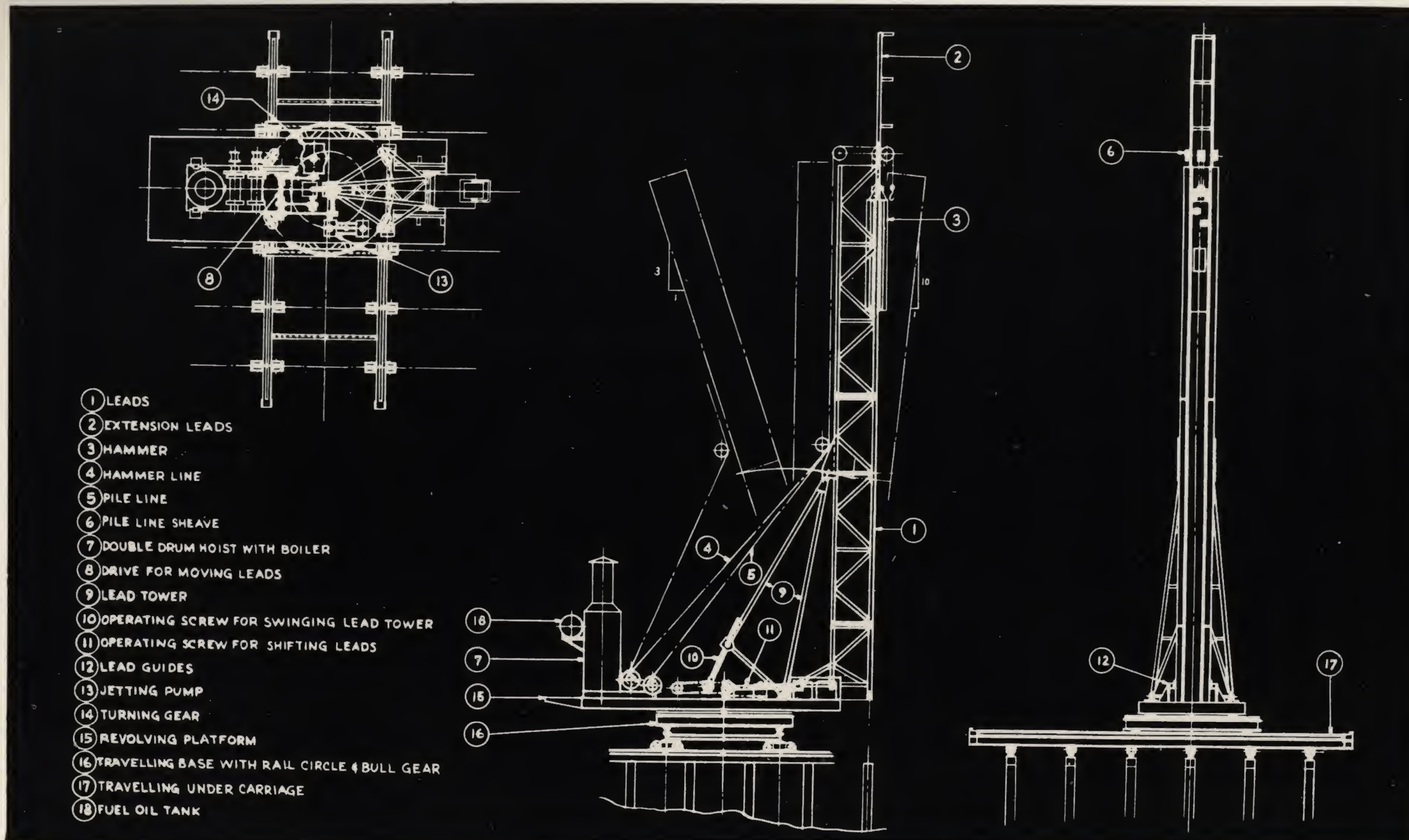
McKIERNAN-TERRY 64-B-2 SKID ROLLER-MOUNTED PILE DRIVER

Designed to work with McKiernan-Terry Hammer, the fixed leads are pin-connected, for ease in erection, as shown, and are provided with extra upper and lower sections. The rig is easily moved by rolling on the heavy steel oak-filled rollers, or skidded laterally when using the tackle provided and hoist winch heads for power.



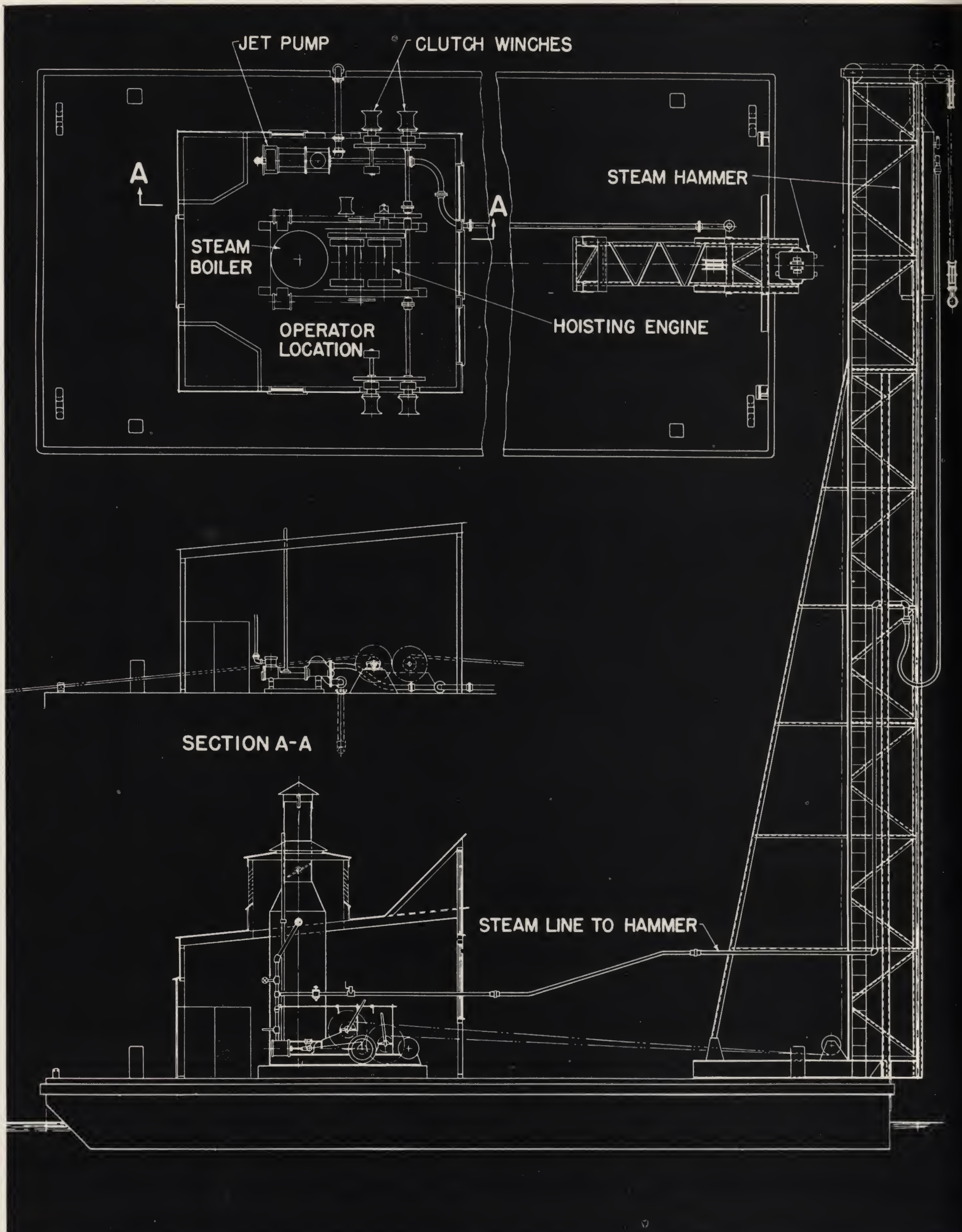
McKIERNAN-TERRY C-1078 SKID PILE DRIVING RIG

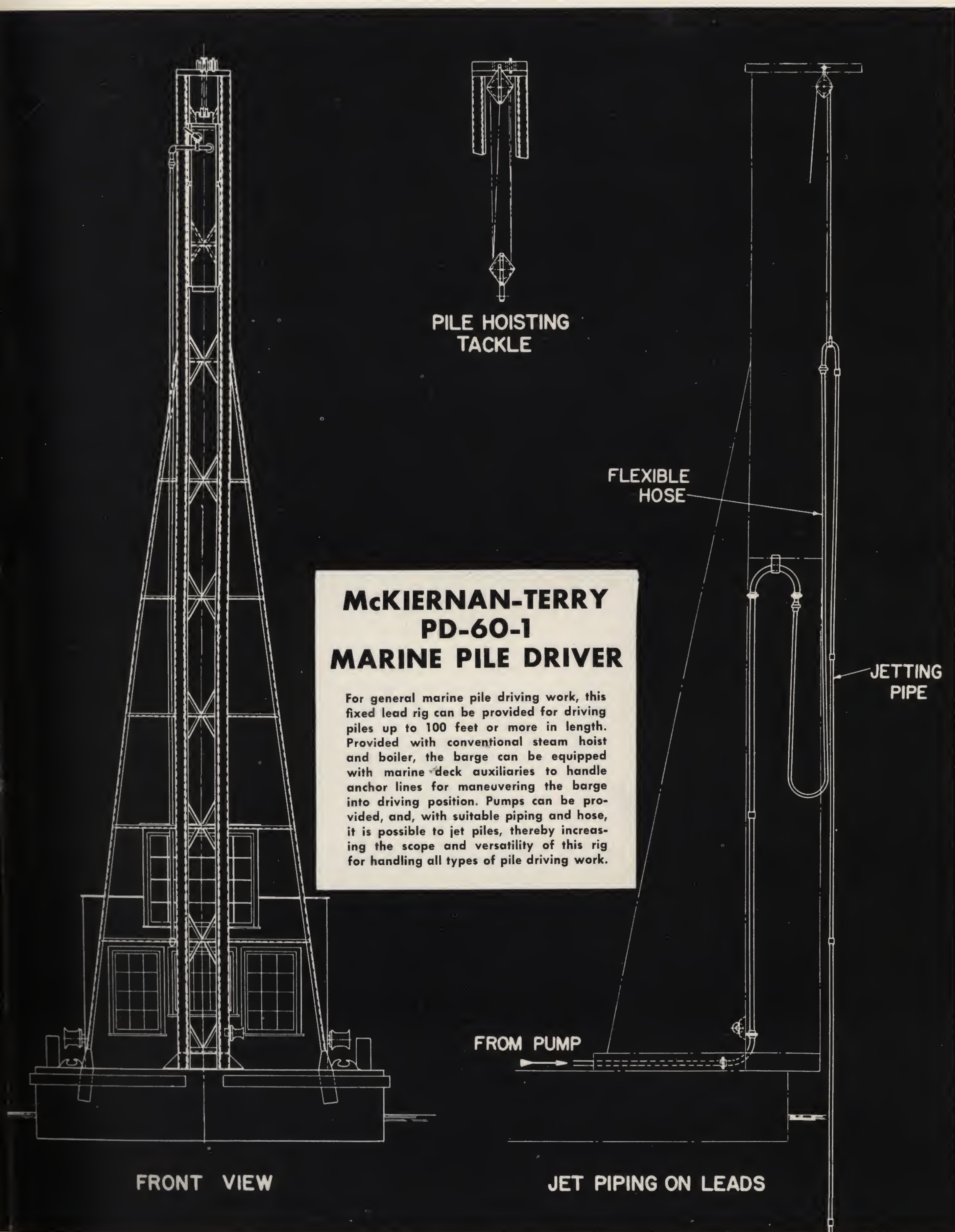
Equipped with fixed leads for driving vertical piles. Mounted on heavy-wall pipe rollers, oak-filled, the rig, as shown at upper left hand corner, is moved either fore or aft, or laterally by using tackle provided. Winch heads on the hoist drum shafts provide the motivating power.



McKIERNAN-TERRY C-02587 TURNTABLE PILE DRIVER

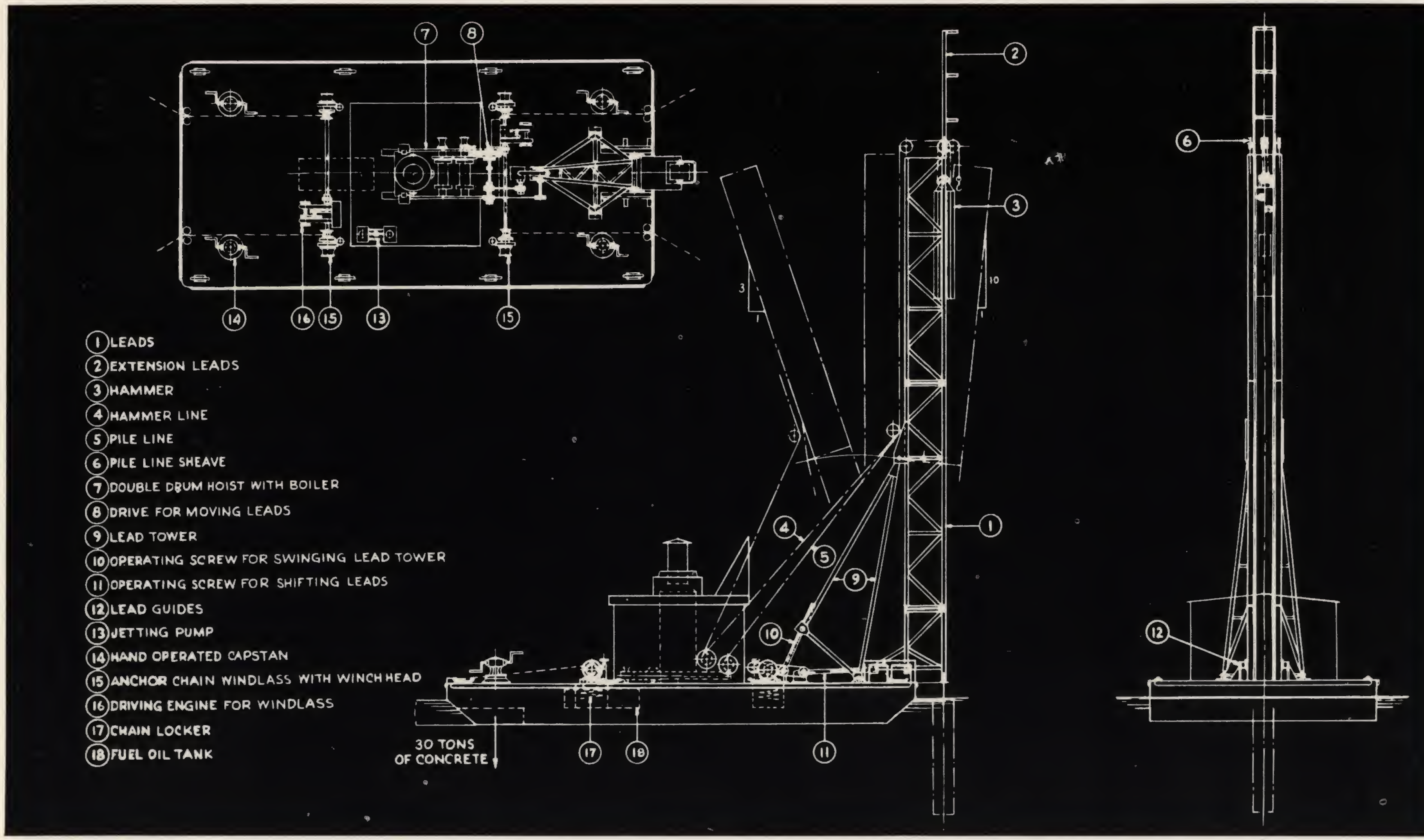
Designed for general-purpose land operation. The rig is mounted on wheels, in such a manner that it can be rotated a full 360°. In addition, it can be rolled sidewise on the undercarriage. The undercarriage, being equipped with wheels, can be rolled along rail foundations placed on existing piles or other substructure. This McKiernan-Terry turntable pile driver is complete with steam boiler, steam hoist, jetting pump and an air compressor for underwater driving. It is equipped with adjusting mechanisms for moving the leads fore or aft on the rig, as well as for adjusting the batter to the leads, from 1 to 3 backward or 1 to 10 forward.


JET PUMP
CLUTCH WINCHES
A
A
STEAM HAMMER
STEAM BOILER
HOISTING ENGINE
OPERATOR LOCATION
SECTION A-A
STEAM LINE TO HAMMER



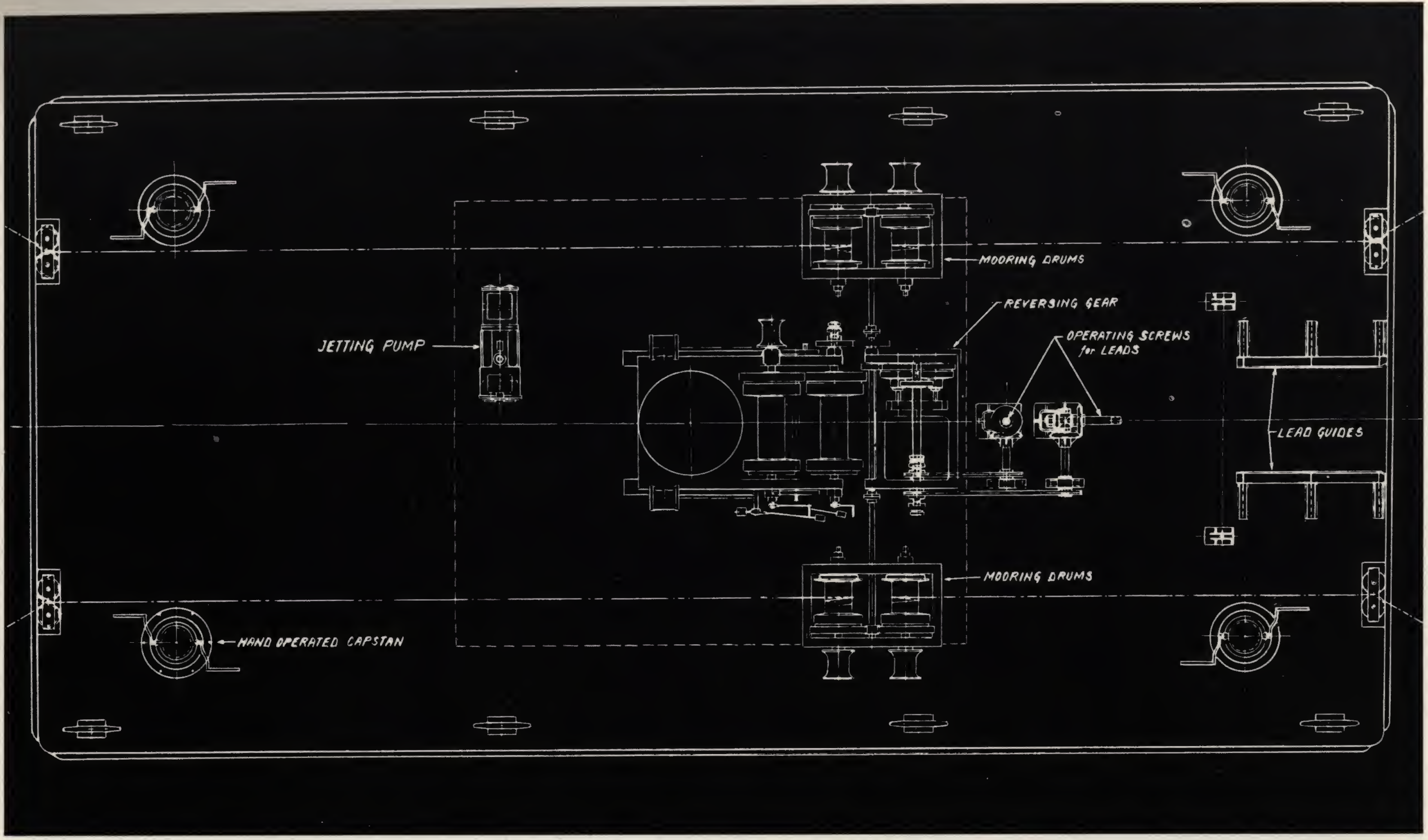
McKIERNAN-TERRY PD-60-1 MARINE PILE DRIVER

For general marine pile driving work, this fixed lead rig can be provided for driving piles up to 100 feet or more in length. Provided with conventional steam hoist and boiler, the barge can be equipped with marine deck auxiliaries to handle anchor lines for maneuvering the barge into driving position. Pumps can be provided, and, with suitable piping and hose, it is possible to jet piles, thereby increasing the scope and versatility of this rig for handling all types of pile driving work.



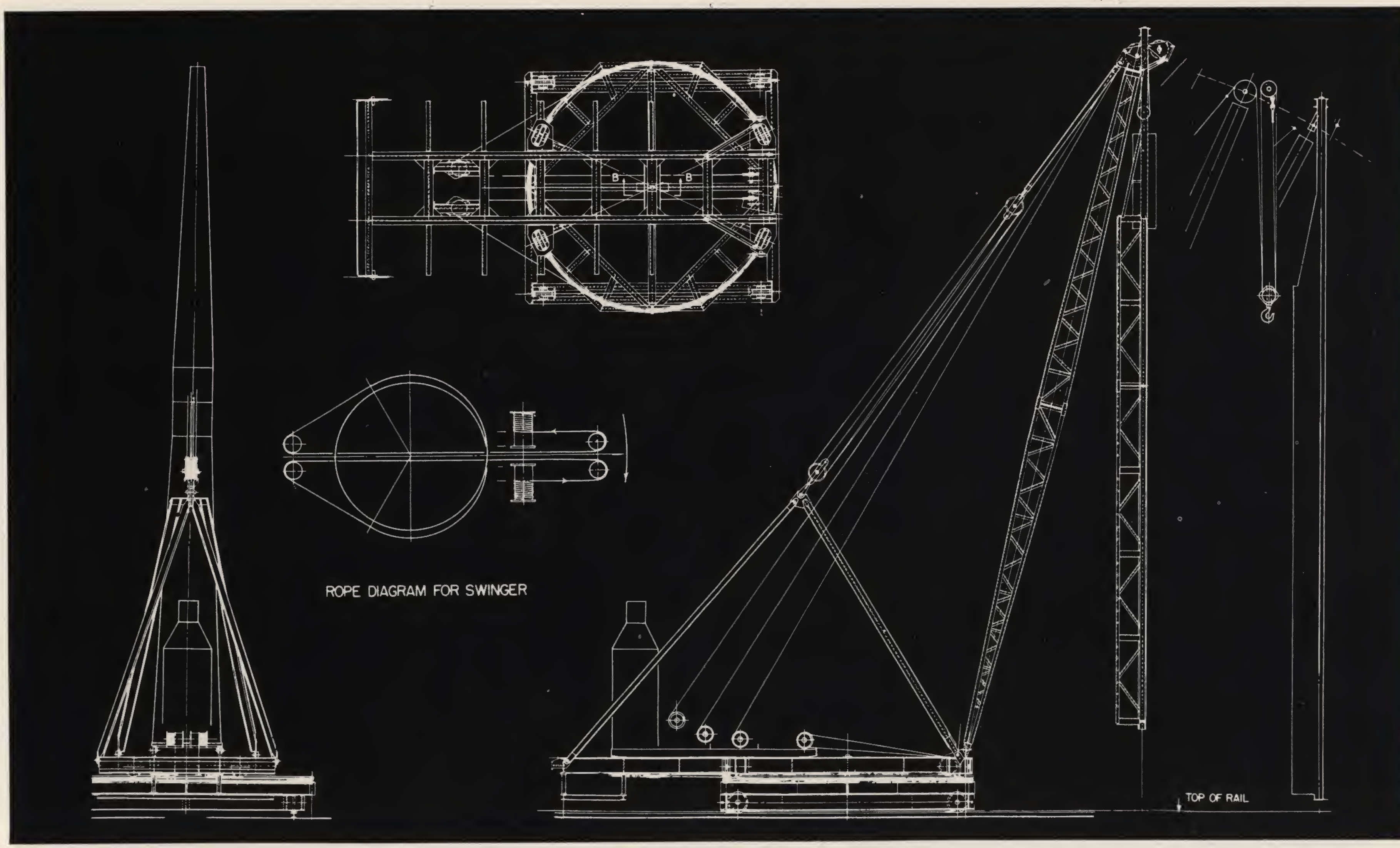
McKIERNAN-TERRY C-02586 FLOATING PILE DRIVER

Complete with barge, for general purpose marine pile driving work. The leads are to be supported in such a manner that the batter angle can be adjusted from 1 to 3 backward to 1 to 10 forward. In addition, the leads can be moved fore and aft of the barge a distance of approximately 5 feet, which further assists in accurately stopping the piles prior to driving, without adjusting location of barge. Barge comes completely equipped with steam boiler, steam hoist, jetting pump and an air compressor for driving under water; also with steam auxiliary engines for driving anchor windlasses. In addition, if desired, four hand-operated windlasses may be mounted on the barge, as shown in the drawing, part No. 14. These will enable the moving of the barge when steam power is not available.



McKIERNAN-TERRY C-02634 FLOATING PILE DRIVER MACHINERY

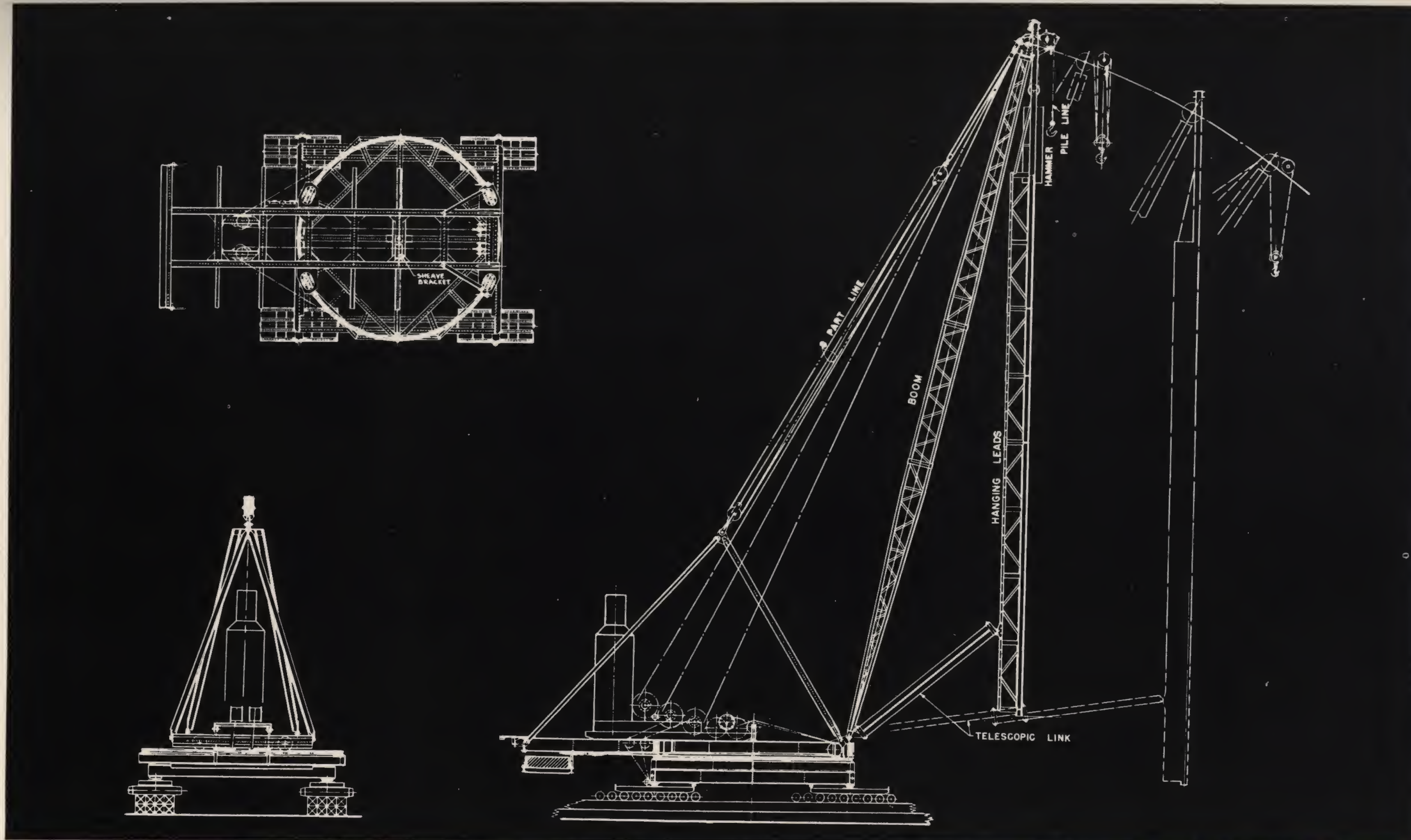
An arrangement in common use in the United States for maneuvering barges by means of double drum hoists, in preference to separately powered steam-driven anchor windlasses. This arrangement results in simplicity, ease of maintenance and maximum deck space. The drums are of friction type, with brakes independently operated and powered by means of the main hoisting engine. In this case an anchor line will consist of wire rope to which the conventional type anchors can be attached. It is important to note that four anchors have been provided. This enables maneuvering of the barge sideways, as well as fore and aft, to locate the leads as accurately as possible prior to driving. Further fine adjustment of the crew-operated mechanism locates the leads at the precise point where the pile is desired to be driven.



McKIERNAN-TERRY B-1066 ROTATING-CRANE TYPE WHEEL-MOUNTED PILE DRIVER

A highly versatile pile driving rig mounted on a full roller circle. Can rotate 240°, and leads can be rotated 90°, enabling the driving of piles in any position. The rig is mounted on an under-frame equipped with wheels to roll the driver forward. Can be equipped with a second wheel-mounted under-frame to allow transverse propelling.

When thus equipped, this McKiernan-Terry rotating-crane type pile driving rig is able to serve a wide area of operations with a minimum of effort. By removing the leads, this rig can be used also as a traveling derrick. It may furthermore be used for dredging operations, with the addition of a bucket.



McKIERNAN-TERRY PD-51-1 ROTATING-CRANE TYPE ROLLER-MOUNTED PILE DRIVER

Mounted on a full roller circle to allow the rig to be rotated through 240°. Equipped with hanging leads which can also be rotated on their axis. The lower end of the leads is secured with an adjustable strut for driving piles vertically or on a batter up to 1 to 3. Can also be provided with wheel-mounted under-carriages, as shown on opposite page. With leads removed, can be used as a 15-ton derrick for hook or bucket work. Designed to accommodate almost any pile hammer. When provided with extension leads and mounted on a barge, is excellent for underwater marine pile driving work.

McKIERNAN-TERRY PRODUCTS

DOUBLE-ACTING PILE HAMMERS
DOUBLE-ACTING PILE EXTRACTORS
SINGLE-ACTING PILE HAMMERS   PILE DRIVING LEADS
COMPLETE PILE DRIVING UNITS   MINE—QUARRY HOISTS
HEAVY HOISTING AND SPECIAL CRANE EQUIPMENT
MAN TROLLEYS COAL AND ORE BRIDGES GRAB BUCKETS
HEAVY MATERIAL UNLOADERS
SHIP AUXILIARY EQUIPMENT—STEERING GEARS
CAPSTANS—WINCHES—WINDLASSES
CABLEWAYS   STEEL DERRICKS AND FITTINGS
LIGHTER DERRICKS   CAR PULLERS   DREDGE ENGINES
BRIDGE OPERATING MACHINERY
POWER BLACKSMITH HAMMERS

SPECIAL MACHINERY COMPLETELY DESIGNED,
ENGINEERED AND MANUFACTURED

SPECIAL MACHINERY MANUFACTURED FROM YOUR DESIGN

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